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IATA

SAFETY REPORT 2014

Issued April 2015

51st Edition

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International Air Transport Association
Montreal—Geneva

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NOTICE

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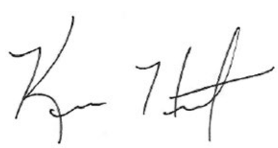
Senior Vice-President Foreword



Captain Kevin Hiatt
Senior Vice President
Safety and Flight Operations

Dear colleagues,

The global airline community is celebrating a special anniversary this year: it was 70 years ago that 57 airlines from 31 countries joined together to form the International Air Transport Association (IATA). The international scheduled air transport industry is more than 100 times larger than it was in 1945 and IATA has grown as well, with some 250 member airlines in more than 115 countries that account for 84% of global air traffic.

Commercial aviation has changed dramatically over the past 70 years, as governments have come to embrace liberalization and free market competition as being superior to the tight economic and commercial regulation that characterized the industry for decades.

What has not changed, however, is aviation's commitment to improving safety. The data show we have been very successful; aviation's safety record is superb and getting better. Nevertheless, 2014 was an extraordinarily challenging year for our industry that reminds us that there is no room for complacency.

Furthermore, as aviation stakeholders work to respond to unique events such as the disappearance of MH 370, it is vital not to lose focus on the data-driven, risk-based approach that history has proven delivers the largest impact in improving safety.

There are so few accidents that they cannot yield the trend data that is vital to a systemic risk-based approach to reducing accidents. The Global Aviation Data Management (GADM) project will give us the tools to take a predictive look—to see where the data are leading us, instead of a reactive look from an accident investigation.

I am pleased to offer you this 51st edition of the IATA Safety Report and 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.

“While the number of LOC-I accidents has gone down to only six accidents in 2014, it is still a number worth looking at”

Chairman Foreword

Dr. Dieter Reisinger
Chairman ACTF

"Tragic" and "otherwise good on average", these are likely the words we would use if we had to summarize 2014 with respect to commercial aviation safety performance.

Tragic is the loss of MH370. Had anyone suggested, prior to the disappearance of MH370, that 300 tons of metal could simply vanish without the slightest signs of debris; even experts would likely have answered with a definite 'no'. The industry sadly learned otherwise: MH370 has been declared missing and therefore counts as an aviation accident. Lacking information, we had to classify it with "I" for insufficient data.

Tragic is also the loss of MH17. It is not the first time that commercial transports have been shot down, either by accident or deliberately. As tragic as this event is, we did not consider MH17 an aviation accident. It is an unlawful act and will therefore be considered in the statistics on aviation security. Therefore, the loss of MH17 is not included in the final figures of this report.

The second term to describe the year 2014, "otherwise good on average", means that, MH flights aside, the year overall was a good one for commercial aviation. The ACTF team members had to classify mainly gear collapses and we wonder if these were related to design issues (perhaps underestimating fatigue loads) or faulty maintenance procedures. We have seen that trend for mechanical failures contributing to accidents in recent years. We also saw a typical share of runway excursions, hard landings and tail strikes. Fortunately, these events have a good survival rate.

While the number of LOC-I accidents has gone down to only six accidents in 2014, it is still a number worth looking at. Why do pilots lose control of their aircraft? Why are they unable to recover? These are the questions that need to be answered. No doubt, there are multiple paths that lead to LOC-I situations, such as inadequate crew resource management, high fatigue levels among crew members, lack of manual handling skills in general and in particular on the edge of the flight envelope, over-reliance on automation and, last but not least, design issues.

All weather operations does not imply that modern aircraft can operate in all kinds of weather. We still have to respect the power of nature! Therefore, ACTF decided to add recommendations regarding the use of modern technology to forecast and present real-time weather to pilots for enhanced situation awareness. The technology is available; it just does not find its way into the average commercial flight deck.

I wholeheartedly thank the entire team, all ACTF members and IATA staff for producing this report and we hope that it contains valuable statistical data and information that can transfer into your respective airline flight operations. We hope that the report is of use to all stakeholders in aviation.

Safety Report 2014 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.

In an effort to enhance the report, some changes have been made when compared to previous reports: the first is the end of the distinction between Eastern and Western-built aircraft. With today's modern design, manufacturing processes and global markets, this East/West division is no longer relevant for the analysis of accidents and a more holistic approach is preferred. The second change is also the removal of the split between modern and classic aircraft. Today's modern technologies (FMS and glass cockpits, for example) being retrofit into what was once considered a 'classic aircraft' makes it difficult to make a clear distinction between the two types. Third, in the Cabin Safety section, three additional cabin end states were added in 2014: Abnormal Disembarkation, Normal Disembarkation and Hull Loss/Nil Survivors.

	Jet	Turboprop	Jet Hull Loss Rate	Turboprop Hull Loss Rate	Fatal Accidents	Fatalities
2014	39	34	0.23	2.30	12	641
2013	38	43	0.41	2.79	16	210
Previous 5 Year Average (2009-2013)	48	38	0.58	2.78	19	517

Accident Summary

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 page 95 for ICAO's accident definition). In total, 73 accidents met the IATA accident criteria in 2014. In line with the 2013 Safety Report, 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 page 91 of this report. The criteria for the harmonized GSIE accidents, first introduced in 2011, also include injury-only accidents with no damage to aircraft.

Summary data for 2014 provide the following observations:

Count Data:

- There were 641 fatalities from commercial aviation accidents in 2014, increased from 210 in 2013 and above the previous five-year average of 517;
- 12 fatal accidents (all aircraft types) versus 16 in 2013 and the five-year average of 19;
- 16% of all accidents were fatal, below the five-year average of 22%;
- 3 fatal hull loss accidents involving jets, down from 6 in 2013, and the five-year average of 8;
- 7 hull loss accidents involving jets compared to 12 in 2013 and the five-year average of 16;
- 17 hull loss accidents involving turboprops of which 9 were fatal.

Accident Rate Data:

- 2014's overall accident rate was of 1.92 accidents per million sectors, 14% lower than 2013's overall accident rate of 2.24 and 23% below the previous five-year (2009-2013) average of 2.48;
- The 2014 global jet hull loss rate was 0.23. This was an improvement from 2013 when the global jet hull loss rate was at 0.41. Looked at over the previous five-year period (2009-2013), 2014 shows a 60% improvement from the average of 0.58;
- The 2014 jet hull loss rate for members of IATA was 0.12, which outperformed the global average by 48% and which showed 64% improvement over the five-year average for IATA members of 0.33;
- The 2014 global turboprop hull loss rate was 2.30. This was an improvement from 2013 when the global turboprop hull loss rate was at 2.79. Looked at over the previous five-year period (2009-2013), 2014 shows a 17% improvement from the average of 2.78;
- The 2014 turboprop hull loss rate for members of IATA was 0.93, which outperformed the global average by 60% and which showed 19% improvement over the five year average for IATA members of 1.14.

Regional Performance Highlights

All of the regions saw their jet hull loss rate improve when compared to the 2009-2013 period:

- Africa (0.00 compared to 6.83)
- Asia/Pacific (0.44 compared to 0.63)
- CIS (0.83 compared to 2.74)
- Europe (0.15 compared to 0.24)
- Latin America and the Caribbean (0.41 compared to 0.87)
- Middle East-North Africa (0.63 compared to 1.82)
- North America (0.11 compared to 0.20)
- North Asia (0.00 compared to 0.06)

Although CIS had the worst performance (0.83) among the regions, it scored the best year-to-year improvement for three consecutive years: from 6.34 in 2011 to 1.91 in 2012 and then 1.79 in 2013 and 0.83 in 2014.

For turboprop hull loss accidents, Asia/Pacific experienced 0.00 accidents in 2014, while Africa experienced the highest rate among the regions at 14.13 accidents per million sectors, which also exceeded the region's five-year average of 9.62 and the 2013 hull loss rate of 7.51. North Asia saw its turboprop hull loss rate increase from 0.00 in 2013 and 2.41 in the five-year average, to 11.28 in 2014. However, the increase in North Asia is due to the fact that there was only one turboprop hull loss in 2014 (while in the previous five years there was only one turboprop accident, which occurred in 2012), combined with an extremely low sector count compared to the other regions (8% below the average for all other regions and representing only about 1% of the global sector count for turboprops).

In 2015, IATA will continue to work with its members to maintain safety as a priority. Building on the initiatives outlined in the IATA Safety Strategy, IATA will continue to represent, lead and serve the aviation industry in this critical area.

Increased Focus on Turboprop Operations

The overall accident rate for turboprops in 2014 was of 4.61 accidents per million sectors. The IOSA-registered airlines, however, have performed much better: in the last five years their overall accident rate was twice as low as their non-IOSA registered counterparts (2.93 compared to 6.42) and about six times lower in terms of hull losses (0.63 compared to 3.93). Similar ratios are found when comparing the accident rates on IOSA versus non-IOSA registered jet aircraft operators.

Additionally, the accident rate where aircraft design was one of the contributing factors was virtually the same for both jet and turboprop aircraft at approximately 0.10 accidents per million sectors. In 5% of the jet accidents, aircraft design was known to have been a contributor, while the ratio for turboprops was 2%.

The shortfall existing in the significantly higher accident rate for turboprop aircraft is being addressed by IATA and other stakeholders through increased focus on improved safety awareness, systems, training and airport infrastructure serving this type of operation.

Operators in all sectors continue to deliver better safety performance when the operator's operational infrastructure, including that of its safety management capabilities, is robust. Operational standards such as IOSA, which require this robust infrastructure, are a key to safer operations.

All Weather Operations

Weather can almost always be considered a contributing factor, not only to accidents, but also to flight delays and increased costs caused by route diversions. 'All weather operations' does not mean that airlines should be operating in every type of weather, even when considered unsafe. Rather it means that the knowledge and awareness of all weather phenomena and how they can affect safety needs to be an integral part of every flight.

It has been noted that failure of an operator's dispatching systems to provide the flight crew with up-to-date severe weather information pertaining to the aircraft's intended route of flight or destination has been a major contributing factor in several accidents and incidents. Therefore operators are encouraged to improve timely dissemination of severe weather information.

There is a wealth of information on all weather operations available in books, papers and on the Internet. Section 9 of this report is intended to provide a concise summary on this topic that will, hopefully, increase the interest and awareness of crews, dispatchers and industry stakeholders to do additional research for improved decision-making skills, technologies and overall knowledge of this ever-present topic.

Predictive Analysis

Last year, the IATA Safety Report featured a chapter on the exploration of predictive analysis. Although additional information is not included in this year's report, IATA is committed to furthering its research in this area throughout 2015 and onwards, as much still needs to be understood and developed.

With accident rates reaching historic lows there is a need for the development of new methodologies that would allow for a timely identification of precursors to accidents to complement the already existing tools.

IATA Operational Safety Audit

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 2014 was 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 October 2014, 154 (38%) of the 402 airlines on the IOSA registry were non-IATA member airlines. Enhanced IOSA (E-IOSA) is the project under which IOSA-registered operators will demonstrate improved internal assurance programs and under which the audit procedures are further improved. In September 2015, E-IOSA will become mandatory for all renewal audits and the prefix "Enhanced" will disappear.

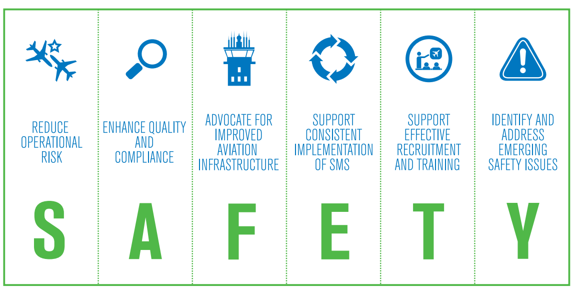
IATA Standard Safety Assessment

There are operators that are not eligible for an IOSA audit because of operating aircraft below 5,700 kg Maximum Takeoff Weight, or because their business model does not allow conformity with other IOSA requirements. Because of the vast majority of operators and flights performed are outside the scope of IOSA, IATA has taken the opportunity to utilize all reasonable synergies provided by the IOSA program to develop a new evaluation program for the industry called IATA Standard Safety Assessment (ISSA). The ISSA program will assess an operator's operational safety every two years. More information can be found under www.iata.org/issa.

IATA Safety Strategy

In September 2013, the IATA Safety Group initiated a comprehensive review of the IATA Six-Point Safety Strategy. Building on Safety Management Systems (SMS) principles, the Group reviewed input from several sources, including issues raised by airlines at the biannual Incident Review Meetings as well as analysis of safety factors by IATA's Global Aviation Data Management (GADM) team. GADM provides IATA members and other industry partners with a wealth of information and acts as a portal for multiple sources of aircraft operational data. This critical input formed the foundation of the revised Safety Strategy which was endorsed by IATA's Operations Committee (OPC) in October 2013.

IATA's Six-Point Strategy reflects the current operational environment and provides the framework for proactive initiatives to mitigate the main causes of aviation accidents and incidents.



IATA'S SIX-POINT SAFETY 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 subcategories to address specific aspects of the strategy.

REDUCE OPERATIONAL RISK

As a natural consequence of the service they provide, airlines are exposed to operational risks which must be continuously monitored and mitigated. IATA, through its Global Aviation Data Management (GADM) program, has identified three major areas of concern:

1. Loss of control in-flight
2. Controlled flight into terrain
3. Runway safety

Other areas of operational risk identified include:

4. SID/STAR phraseology
5. Cabin safety
6. Fatigue risk

To address these areas, the IATA Safety Group has developed programs and strategies to reduce the operational risk to IATA's member airlines and the aviation industry in general.

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. Between 2010 and 2014, airplane accidents resulting from a LOC-I event were the leading cause of fatalities in commercial aviation.

While few in number, LOC-I accidents are almost always catastrophic; 97% of LOC-I accidents between 2010 and 2014 involved fatalities to passengers and/or crew. Over this period, 9% of all accidents were categorized as LOC-I. LOC-I accidents contributed to 43% of fatalities during the past five years (1,242 out of 2,541). There were six LOC-I accidents in 2014, all of which involved fatalities. Given this severity, LOC-I accidents represent the highest risk to aviation safety.

Analysis of LOC-I accident data indicated that LOC-I can result from engine failures, icing, stalls or other circumstances that interfere with the ability of the flight crew to control the motion of the aircraft. It is one of the most complex accident categories, involving numerous contributing factors that act individually or, more often, in combination. These contributing factors include latent conditions in the system, external threats to the flight crew, errors in the handling of those threats and undesired aircraft states from deficiencies in managing these threats or errors.

Many initiatives by IATA and other organizations, manufacturers and regulatory authorities have been underway simultaneously to influence the reduction of the number of LOC-I events. ICAO brought many of the groups involved with these efforts into the ensuing discussions under what became known as the Loss of Control and Recovery Training (LOCART) initiative.

Still, there remains no single, simple solution for mitigating the risk of LOC-I events. IATA has embarked on a number of initiatives to increase the attention devoted to this important area of concern:

- IATA, in collaboration with aviation safety partners, is developing a LOC-I website to provide a single-point-of-consultation where all relevant LOC and Aircraft Upset Recovery Training Aids (AURTA) will be available. The Manual of Aircraft Upset Prevention and Recovery Training

(DOC 10011) was developed with input from many expert groups from IATA, flight simulator manufacturers, aircraft manufacturers, airlines, etc.

- A toolkit, which will mirror the website, will also be developed for workshop purposes.
- To address the lack of LOC training, the implementation of training programs in recurrent training, and the proper training of instructors, IATA's Pilot Training Task Force has developed guidance material for LOC training.

Controlled Flight into Terrain

Most Controlled Flight into Terrain (CFIT) accidents occur in the approach and landing phases of flight and are often associated with lack of precision approaches.

There were five CFIT accidents in 2014. In the period from 2010 to 2014, data from the IATA GADM program shows that 41% of CFIT accidents involved the lack or unavailability of precision approaches. There is a correlation between the lack of Instrument Landing Systems (ILSs) or state-of-the-art approach procedures - such as Performance-based Navigation (PBN) - and CFIT accidents. IATA works collaboratively with industry stakeholders such as ICAO, Air Navigation Service Providers (ANSPs) and airlines to leverage each of the pillars of our safety strategy as they relate to PBN implementation. To reduce the risk of CFIT:

- IATA is continuing its work with states, ANSPs, airlines, and international and regional organizations to accelerate the implementation of PBN in accordance with ICAO General Assembly resolution A-37-11.
- After the success of the PBN Go Teams, the focus now is on implementation to take advantage of the awareness raised during the Go Teams.

Runway Safety

IATA GADM statistics show that runway safety remains an area of concern for the industry. Events such as runway excursions, runway incursions, hard landings and tail strikes are a persistent problem affecting operators worldwide.

From 2010 to 2014, the most frequent type of runway safety accident is runway excursion, representing 22% of all accidents over the period. Survivability of such accidents is high, with less than 6% of fatalities over the previous five years.

While acknowledging the progress made by the industry, IATA recognizes the need for continued improvement in runway safety, which is one of the industry's principal risk areas. IATA is focusing its efforts, attention and resources to reduce risk in areas that include runway incursion, wrong runway departures, phraseology, as well as the errors committed by pilots, air traffic controllers, etc.

IATA has embarked on the following series of programs:

- Through effective outreach and awareness initiatives, IATA shares information and lessons learned on runway safety issues, hazards and effective solutions with all industry stakeholders.
- The establishment of runway safety programs using a multidisciplinary approach is effective and important to mitigate the effects of runway excursions, runway incursions and help prevent occurrences related to runway safety. Improving runway safety requires a collection of initiatives, each providing incremental improvement to runway safety. IATA is an active partner in this multi-stakeholder Runway Safety Program sponsored by ICAO. IATA and all Runway Safety Partners are working together globally to minimize risks of runway incursions, excursions and other hazards.
- IATA continues to work with Airports Council International (ACI), Civil Air Navigation Services Organization (CANSO), European Aviation Safety Agency (EASA), Federal Aviation Administration (FAA) and ICAO, and continues to lead the establishment of a common taxonomy and runway safety key performance indicators (KPIs) to identify key areas of concern.
- IATA GADM produces airport analysis and accident analysis with the view of supporting Regional Aviation Safety Groups (RASGs) and Runway Safety Go-Teams.
- IATA is conducting a study report on SIDs/STARs phraseology that will be available in 2015.

SID/STAR Phraseology

The revised ICAO procedures related to published altitude restrictions on standard instrument departure (SID) and standard terminal arrival (STAR), set out in pans ATM DOC 4444, represent inconsistent implementations of SID/STAR provisions globally as well as a significant change to the way flight crews and/or air traffic controllers are expected to respond to climb/descend instructions while following a SID or a STAR. It became apparent that the inconsistency of implementation and application of this revision led to interpretations of the phraseology, which in turn led to assumptions being made by the pilots and/or air traffic controllers.

In an effort to align procedures relating to published altitude restrictions on SID and STAR, IATA and the International Federation of Air Line Pilots' Associations (IFALPA) jointly prepared a separate follow-up survey for airline pilots, as an extension of the 2011 Phraseology Survey, in order to collect information specific to the use of standard words and phrases when air traffic control (ATC) issues clearance instructions on a SID and/or STAR in conjunction with several intermediate altitude restrictions, speed adjustments, and how pilots interpret and acknowledge those instructions.

IATA, together with IFALPA, will publish a SID/STAR Phraseology study as an outcome of the survey to identify risks associated with the problem, taking into account the inconsistent implementations of SID/STAR provisions globally – leading to the development of harmonized recommendations that address those risks.

Cabin Safety

It is our commitment to strive for continuous improvements in cabin safety and achieve higher levels of safety in the cabin in order to provide safe and comfortable transportation to millions of passengers every year. As part of this important effort, global standards as well as effective and consistent practices play a critical role.

IATA steadily works to improve cabin safety standards, revise recommended practices and update best practice guidelines. These efforts contribute to positive airline safety performances and provide operators with the necessary information to address emerging risks and consider new best practices.

In January 2015, IATA released the Guidance on Unruly Passenger Prevention and Management (2nd Edition). While aimed primarily at member airlines, the original version was extensively referenced by regulators, ground handlers and media. This updated version describes the changes as set out in international law (see the Montreal Convention 2014) as well as the latest advice, tools and best practices that airlines can use when implementing new or enhancing existing policies and procedures. This document strongly emphasizes prevention, and aims to avert unsafe situations and unruly incidents from happening in the first place as well as ensuring that they are managed effectively if they do occur. This document can be viewed at: www.iata.org/cabin-safety

Furthermore, in February 2015, IATA released the Cabin Operations Safety Best Practices Guide (2nd Edition) which addresses numerous policies and procedures for cabin crew in normal, abnormal and emergency situations. These guidelines aim to assist airlines in implementing integrated, proactive, effective and efficient cabin safety policies and procedures. As there is no "one-size-fits-all" solution, these guidelines stand as recommendations. Airlines are encouraged to adopt these guidelines as appropriate. IATA is committed to updating these guidelines annually in order to address emerging risks and share new best practices. They can be accessed at: www.iata.org/cabin-safety

In addition, the inaugural Cabin Operations Safety Conference in 2014 facilitated the exchange of lessons learned and industry developments. In order to further elevate and harmonize cabin operations safety best practices worldwide, this important global initiative will take place once again in Paris, France on 5-7 May, 2015. More information at: www.iata.org/cabin-safety-conference

Fatigue Risk

The traditional regulatory approach to manage crew member fatigue has been to prescribe limits on maximum flight and duty hours, and 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.

There is scientific and operational support that FRMS is an effective means of mitigating fatigue risks. An effective FRMS requires a just culture and the co-operation of all stakeholders, including crew members, crew planners and rostering personnel.

To further support member airlines with FRMS implementation, in 2014 IATA 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.

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. IATA's audit programs aim to increase global safety performance and to reduce the number of redundant auditing activities in the industry.

IATA Operational Safety Audit

IATA's Operational Safety Audit (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. The program is now being enhanced to include information from internal assessments made by the operators against the IOSA standards. Enhanced IOSA (E-IOSA) will increase continued conformance with the IOSA standards and augment the value of the audit result. The key elements and changes to E-IOSA are as follows:

- Airline internal Quality Assurance (QA) programs will incorporate internal assessments using the IOSA Standards and Recommended Practices (ISARPs) during the entire 24-month registration.
- A Conformance Report (CR) - a current record of the internal assessments - will be provided to the Audit Organization (AO) before the renewal audit.
- The AO will review and verify the information from the CR as part of the overall IOSA assessment. The emphasis will be on confirmation of an effective QA program.
- Mandatory observations conducted by the AO, to confirm implementation of IOSA standards will be revised and improved. Optional observations/checklists will be made available to the operators under www.iata.org/iosa.

In 2013, airlines began to undergo E-IOSA on a voluntary basis. E-IOSA will become mandatory for all renewal audits on 1 September 2015.

IATA Standard Safety Assessment

Because of the vast majority of operators and flights performed are outside the scope of IOSA, IATA has taken the opportunity to utilize all reasonable synergies provided by the IOSA program to develop a new evaluation program for the industry called IATA Standard Safety Assessment (ISSA).

ISSA will be a voluntary program, driven by the industry's avowed wish to improve operational safety performance and efficiency. Program details are still under development and might be modified.

ISSA is planned to be operated and promoted in cooperation with the Flight Safety Foundation. More information can be found under www.iata.org/issa.

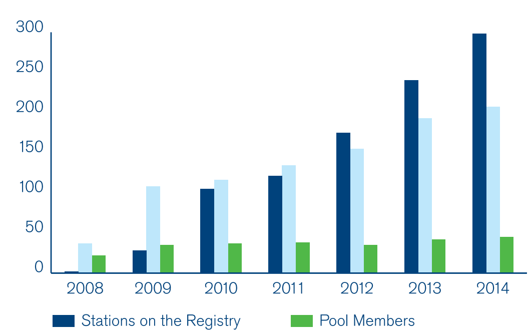
IATA Safety Audit for Ground Operations

The IATA Safety Audit for Ground Operations (ISAGO) program aims to reduce accidents, 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.

Over 960 ISAGO audits have been performed worldwide since 2008. As at 31 January 2015, the ISAGO registry had 167 registered providers with over 300 registered stations at 200 airports worldwide. The ISAGO audit pool includes 45 member airlines with 172 ISAGO qualified auditors.

ISAGO Growth



IATA Fuel Quality Pool

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.

In 2014, the pool had more than 140 member airlines. On average, savings are 81% for the airlines, making this pool not only an efficient tool but also an instrument for harmonization. The network covers 1,257 airports and the pool inspected 888 different Into Plane Agents and suppliers in 2014.

IATA Deicing/Anti-icing Quality Control Pool

The IATA Deicing/Anti-icing Quality Control Pool (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 deicing and anti-icing procedures are followed at all airports. During the 2013-2014 winter season, the pool performed 741 audits and covered a total of 398 stations.

Active members of this pool save an average of 70% on their scheduled inspections, including manpower and resources.

The IATA DAQCP is actively participating with ICAO and SAE in the G12 group with the aim to create a Global Deicing Standard. Documents on methods, training, quality and standard phraseology are being produced.

IATA Drinking Water Quality Pool

The IATA Drinking Water Quality Pool (IDQP) was created by a number of airlines to share audits on drinking-water quality and avoid multiple audits of the same provider at the same location.

The IDQP has developed its own procedures for conducting airfield inspections, using the highest quality standards to ensure water quality. The aim is to safeguard health on board for passengers and crew and to see substantial financial savings from reductions of airport inspection workloads and associated costs.

The pool has reports for more than 300 airports and almost 500 different potable water service providers.

Oversight of Third Party Service Providers

Outsourcing of commercial functions to third party service providers is one of the largest corporate risks for carriers. As part of a carrier's SMS, oversight of third party activities is necessary to ensure hazards are not introduced that could affect the safety and security of aircraft operations. In order to achieve this, the carrier's hazard identification and risk management procedures must be integrated with those of the subcontractor, where applicable. IATA is working with operators and service providers to develop material to facilitate conformity with this requirement.

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
- 10% 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

From 2010 to 2014, 41% of Controlled Flight into Terrain (CFIT) accidents were shown to involve the lack of a precision approach. At their 37th 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 implemented the following ATM infrastructure safety initiatives and activities in 2014:

- 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 program in the United States.

SUPPORT CONSISTENT IMPLEMENTATION OF SMS

A Safety Management System (SMS) is a systematic approach to managing safety, including organizational structures, accountabilities, policies and procedures. In accordance with ICAO requirements, service providers are responsible for establishing a SMS that is accepted and overseen by their state regulator.

In April 2013, IATA introduced the IOSA SMS Strategy - a detailed timeline for the progressive elevation of all SMS designated SARPs to Standards by 2016. We are midway through this timeline, and we continue to monitor audit results to identify specific areas that registrants require additional support, in order to close IOSA findings related to elevated SARPs. To date, such support has included, but is not limited to, initiatives providing tools, additional guidance and/or training on:

- Safety Performance Indicator's (SPIs)
- Enhanced auditor training
- Risk Management
- Safety Culture

To further support SMS implementation in regions requiring more assistance, in 2013 IATA developed and launched the Regional SMS Network for Africa and CIS. The third in a series of workshops will be conducted in 2015, focusing on SPI, change management and safety culture. By facilitating the understanding of the ICAO SMS Framework, the IOSA SMS designated SARPs and explaining how it translates and applies to their operation in practical terms, this program has assisted, and will continue to assist, in more effective implementation and improved conformity in these regions.

Furthermore, IATA continues to be an active member of the ICAO Safety Management Panel (SMP), currently involved in the drafting of the first amendment proposal for Annex 19 – Safety Management, with an anticipated November 2016 applicability. This amendment will provide additional clarity to the existing SMS SARPS through textual improvements and the addition of notes. It will also extend the service provider applicability to include organizations responsible for the type design or manufacture of aircraft, engines or propellers, aligning with amendments to Annex 8. Additionally, this first amendment will also provide enhanced protections to the safety data and safety information gathered from Safety Data Collection and Processing Systems (SDCPS), their sources and use, thus ensuring their continued availability to support safety management activities.

SUPPORT EFFECTIVE RECRUITMENT AND 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 priorities:

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

IATA Training and Qualification Initiative

The IATA Training and Qualification Initiative (ITQI) seeks to modernize and harmonize the training of current and future generations of pilots and maintenance technicians. ITQI is a multi faceted program supporting 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 June 2014:

- 58 states had MPL regulations in place
- 16 states had Authorized Training Organizations (ATOs) running MPL courses
- A total of 2,771 students enrolled and 1,082 graduated

The first edition of the IATA MPL Implementation Guide was published in 2011 to support airlines during their implementation process. The second edition will be published as a cobranded IATA/ICAO/IFALPA manual in 2015.

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 will enable airlines to develop more effective training programs and improve operational safety. In recognition of the importance of competent instructors in any training program, the EBT project 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 for 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

ITQI's Instructor Qualification (IQ) addresses the need to upgrade instructor qualifications to conduct multi-crew pilot license (MPL) and other competency-based training. 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, the MPL training and other ITQI programs being rolled out for pilots and aircraft maintenance mechanics, technicians and engineers (AMMTE) are competency-based. While this method is a paradigm shift for many instructors, it is vital because the competence of a graduate is directly related to the quality of instruction.

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

ITQI's competency-based training for maintenance personnel is designed to establish a competent workforce in aircraft and maintenance organizations through a defined set of standards. The scope of the training is customized for each workplace and the pre-existing workforce competencies.

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 IPTC is to improve the 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 safe operations. IATA actively participated in drafting the ICAO Cabin Crew Safety Training Manual (Doc 10002) which was launched by ICAO in 2014. 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
- 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, ISO 9001 and ISO 27001 certified, is a big data application backed by data warehousing 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. More than 470 organizations around the globe submit their data to GADM and over 90% of IATA member carriers participate.

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, as well as analysis from IATA's GADM program. The initial deliverable for the HITF in 2014 was a documented process, not identification of hazards. This process was endorsed in Q4 2014.

The Hazard Identification Process (HIP) allows IATA to be systematic and holistic when identifying hazards – that IATA has a broader view of hazards than is currently available through the IATA Safety Group, Incident Review Meetings (IRM) and GADM. 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 Group is able to provide the industry with comprehensive, cross-database analysis to identify emerging trends and flag hazards 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 Group is currently working on are:

- Transport of lithium batteries
- Safe integration of Remotely Piloted Aircraft Systems (RPAS)
- Laser threats and a proposal to add laser threats to the list of acts of unlawful interference in Annex 17

Transport of Lithium Batteries

The carriage of lithium (LI) batteries can pose a risk to safe operations if the well-defined guidelines are not followed. Non-compliance and misdeclaration of shipments is something that IATA is working to mitigate. Awareness campaigns, lobbying legislative bodies and international organizations, outreach and awareness, and participation in the ICAO and United Nations panels dealing with the issue are just some of the ways that IATA is being proactive.

Recently, IATA was intrinsically involved in the ICAO Dangerous Goods Panel deliberations on the carriage of LI metal batteries as cargo on passenger aircraft. This embargo has now been accepted by all ICAO member states as of January 2015. This, along with many other developments and mitigations are fully documented in IATA guidance material, including the new and world's first, Lithium Batteries Risk Mitigation Guidance for Operators, a free of charge publication created by the IATA Safety Group.

Remotely Piloted Aircraft Systems (RPAS)

The development of Remotely Piloted Aircraft Systems (RPAS) has opened a new chapter in the history of aviation. The RPAS includes a remotely piloted aircraft (RPA), its associated remote pilot station(s), the required command and control links and any other components as specified in the type design. In addition to the potential use of RPAS for commercial use, there is a significant increase in RPAS operations for recreational purposes. This has coincided with a significant increase in reports of RPAs operating dangerously near aircraft and airports.

Given the increasing demand for access to airspace and the possibility of international use of RPAS, IATA believes that a harmonized approach to regulation is required. IATA is also supporting and participating in the work of ICAO's Remotely Piloted Aircraft System Panel (RPASP). Over the coming years, the RPASP will develop the Standards and Recommended Practices (SARPs) and Procedures for Air Navigation (PANS) that will lay the foundation for the complete regulation to integrate RPAS into the existing system safely, efficiently and sustainably. In the meantime, ICAO has recently issued a comprehensive Manual on Remotely Piloted Aircraft Systems. IATA urges states that are amending existing rules on RPAS, or drafting new regulations, to utilize this manual. The manual provides guidance on areas such as RPAS certification, airworthiness and operator certification, performance-based technical requirements (including command and control as well as detect and avoid), licensing and initial ATM provisions.

Laser Threats

In the past few years, there has been an increase in incidents of lasers pointed at aircraft. These incidents usually occur on takeoff or landing, which are both critical phases of flight, and usually occur at night. There have also been reports of coordinated illuminations, otherwise known as "cluster attacks", on aircraft. This could include three or four people using lasers with the intention of executing a coordinated illumination of an aircraft during takeoff or landing. There are now reports of laser illuminations in the passenger cabin.

Laser illuminations have the potential to impact flight safety. Regulators worldwide are reacting by establishing procedures for flight crews and developing legislation dealing with offences committed towards aircraft.

The entire aviation industry must work together to ensure that the rising trend of these events does not result in a serious incident. IFALPA, IATA, EUROCONTROL and the NATO/EUROCONTROL ATM Security Coordinating Group (NEASCOG) believe that consideration should be given to updating the list of Acts of Unlawful Interference listed in ICAO Annex 17 to the Chicago Convention in order to better reflect the realities of the current threat to civil aviation. Although many new threats to aviation have emerged, the issue of laser attacks on aircraft clearly does not fit within any of the categories currently listed. Therefore, adding "laser illumination of aircraft" to the list would provide much needed emphasis to this growing threat.

Section 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 51st 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.

INTRODUCTION TO THE IATA SAFETY REPORT 2014

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 2014 Report was produced at the beginning of 2015 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.

Image courtesy of Airbus

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 2014 participants:

Mr. Marcel Comeau
AIR CANADA

Mr. Albert Urdiroz
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. Andre Tousignant
BOMBARDIER AEROSPACE

Mr. David Fisher
BOMBARDIER AEROSPACE

Capt. Torsten Roeckrath (Vice-chairman)
CARGOLUX AIRLINES INTERNATIONAL

Mr. Luis Savio dos Santos
EMBRAER

Mr. Don Bateman
HONEYWELL

Mr. Bruno Ochin (Secretary)
IATA

Mr. Ruben Morales
IATA

Mr. Michael Goodfellow
ICAO

Capt. Arnaud Du Bédat
IFALPA

Capt. Hideaki Miyachi
JAPAN AIRLINES

Mr. Martin Plumleigh
JEPPESEN

Capt. Peter Krupa
LUFTHANSA GERMAN AIRLINES

Mr. Florian Boldt
LUFTHANSA GERMAN AIRLINES

Capt. Ayedh Almotairy
SAUDI ARABIAN AIRLINES

Mr. Steve Hough
SAS

Capt. João Romão
TAP AIR PORTUGAL

Section 2

Decade in Review

AIRCRAFT ACCIDENTS AND FATALITIES

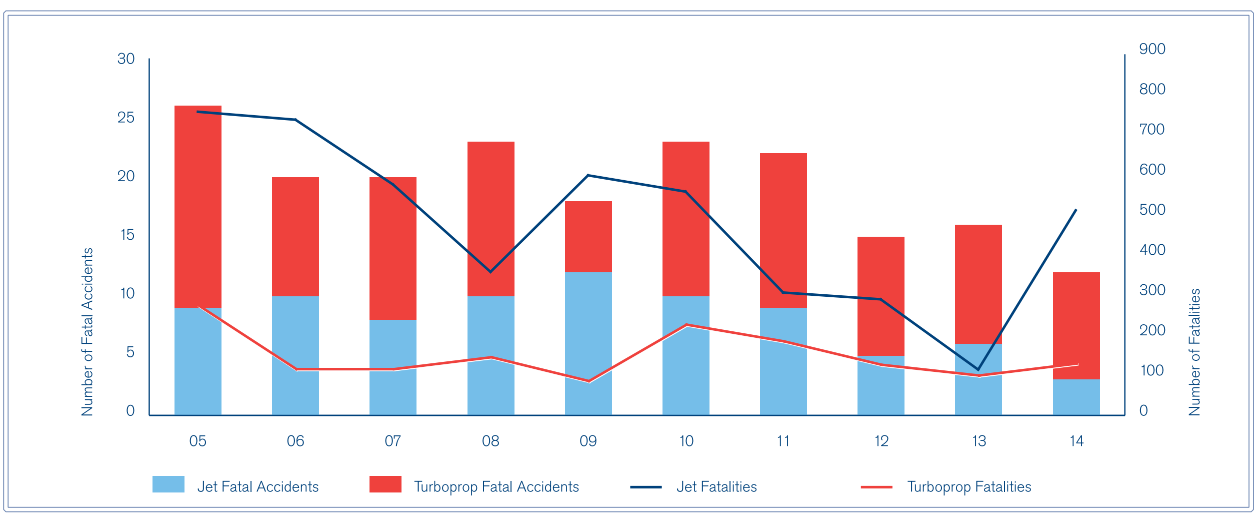
Jet Aircraft Hull Loss Rate:
IATA Member Airlines vs. Non-IATA Member Airlines and Industry (2005-2014)

Turboprop Aircraft Hull Loss Rate:
IATA Member Airlines vs. Non-IATA Member Airlines and Industry (2005-2014)

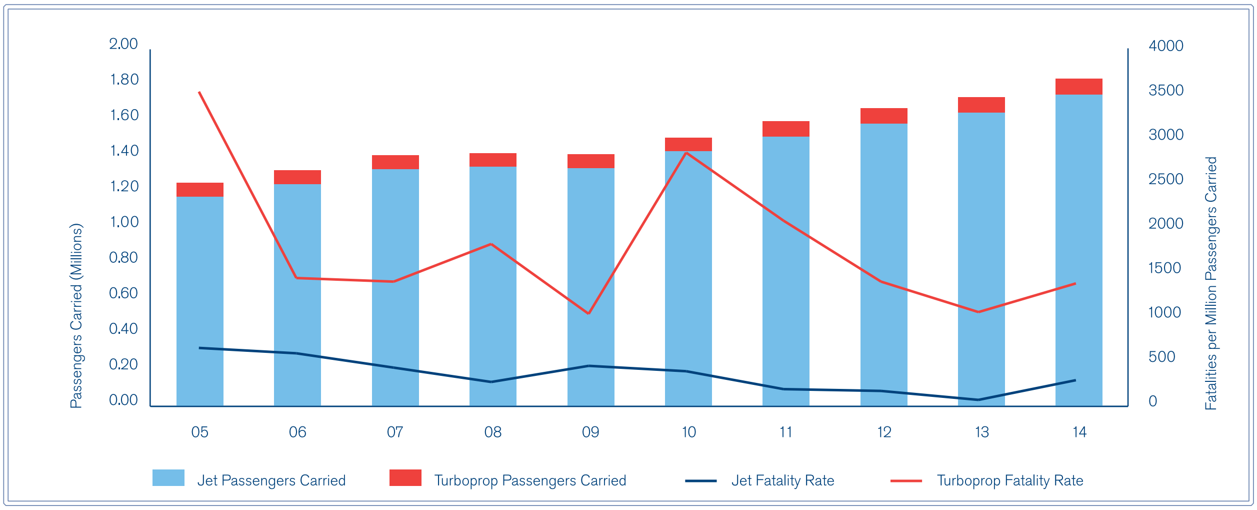
All Aircraft Accident Rate:
IATA Member Airlines vs. Industry (2005-2014)

Note: Includes substantial damage and hull loss accidents for jets and turboprops.

Jet and Turboprop Aircraft:
Number of Fatal Accidents and Fatalities (2005-2014)

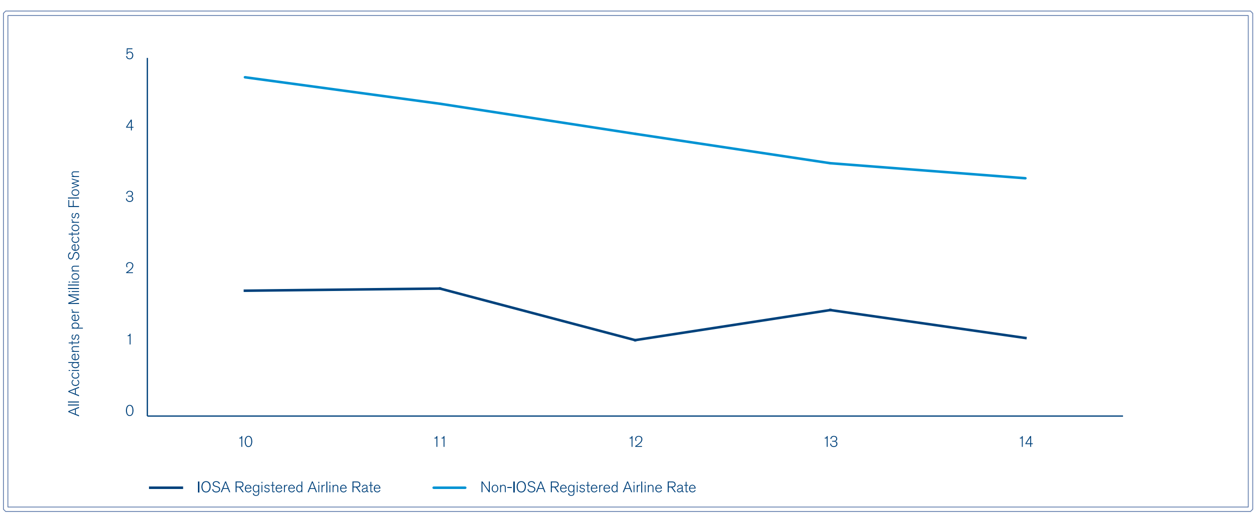


Jet and Turboprop Aircraft:
Passengers Carried and Passenger Fatality Rate (2005-2014)



Source (passengers carried): Ascend - a Flightglobal Advisory Service

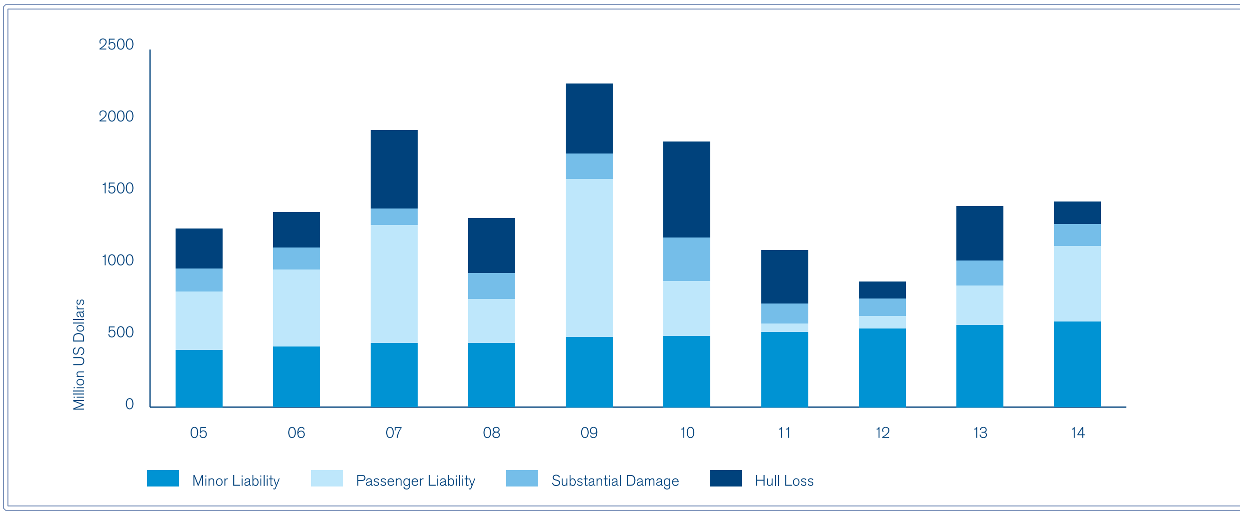
Airline Accident Rate:
IOSA Registered and Non-IOSA Registered (2010-2014)



ACCIDENT COSTS

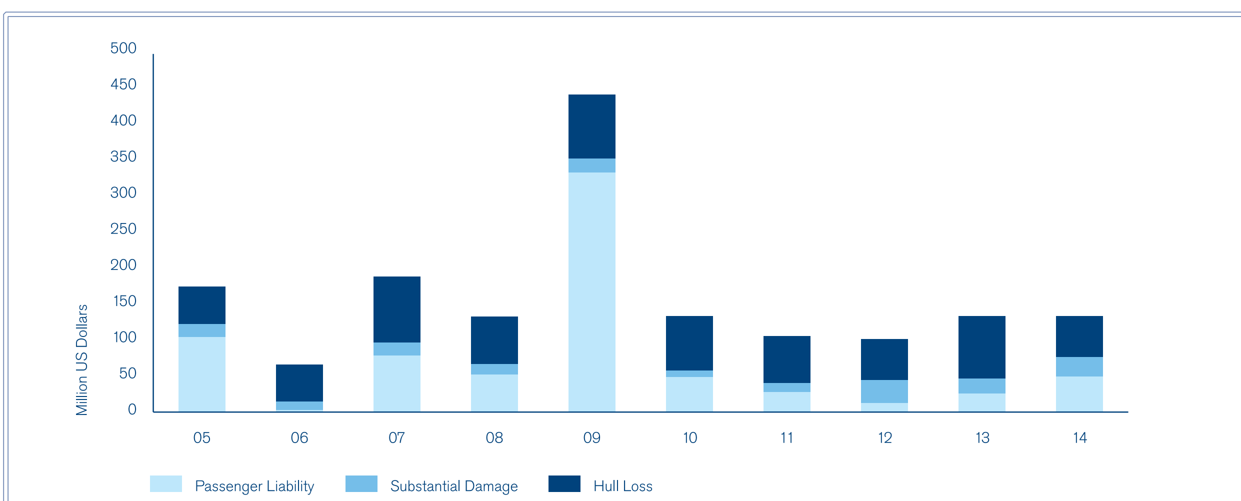
IATA has obtained the estimated costs for all losses involving jet and turboprop aircraft over the last 10 years. The figures presented are from operational accidents and exclude security-related events and acts of violence.

Jet Aircraft:
Accident Costs (2005-2014)



Source: Ascend - A Flightglobal Advisory Service

Turboprop Aircraft:
Accident Costs (2005-2014)



Source: Ascend - A Flightglobal Advisory Service

Section 3

2014 in Review

2014 COMMERCIAL AIRLINES OVERVIEW

2014 Fleet Size, Hours and Sectors Flown

	Jet	Turboprop
World Fleet (end of year)	23,718	5,250
Hours Flown (millions)	62.9	6.3
Sector Landings (millions)	30.6	7.4

Source: Ascend – A Flightglobal Advisory Service

Note: World fleet includes in-service and stored aircraft operated by commercial airlines on 31 December 2014

2014 Passengers Carried

	Jet	Turboprop
Passengers Carried (millions)	3,483	178
Estimated Change in Passengers Carried (2014 vs. 2013)	6.2%	0.3%

Source: Ascend - A Flightglobal Advisory Service

AIRCRAFT ACCIDENTS

There were a total of 73 accidents in 2014. Summaries of all the year's accidents are presented in **Annex 3 - 2014 Accidents Summary**.

2014 Operational Hull Loss Rates

	Jet	Turboprop
Hull Losses (per million sectors)	0.23	2.30
Hull Losses (per million hours)	0.11	2.69

Source: Ascend - A Flightglobal Advisory Service

2014 Operational Accidents

	Jet	Turboprop	Total
Hull Loss	7	17	24
Substantial Damage	32	17	49
Total Accidents	39	34	73
Fatal Accidents	3	9	12
Total Fatalities	517	124	641

2014 Fatal Accidents per Operator Region

	AFI	ASPAC	CIS	EUR	LATAM	MENA	NAM	NASIA
Accidents	12	16	3	11	9	6	12	4
Fatal Accidents	4	2	2	1	0	1	1	1
Fatalities (crew and passengers)	13	401	13	116	0	48	2	48

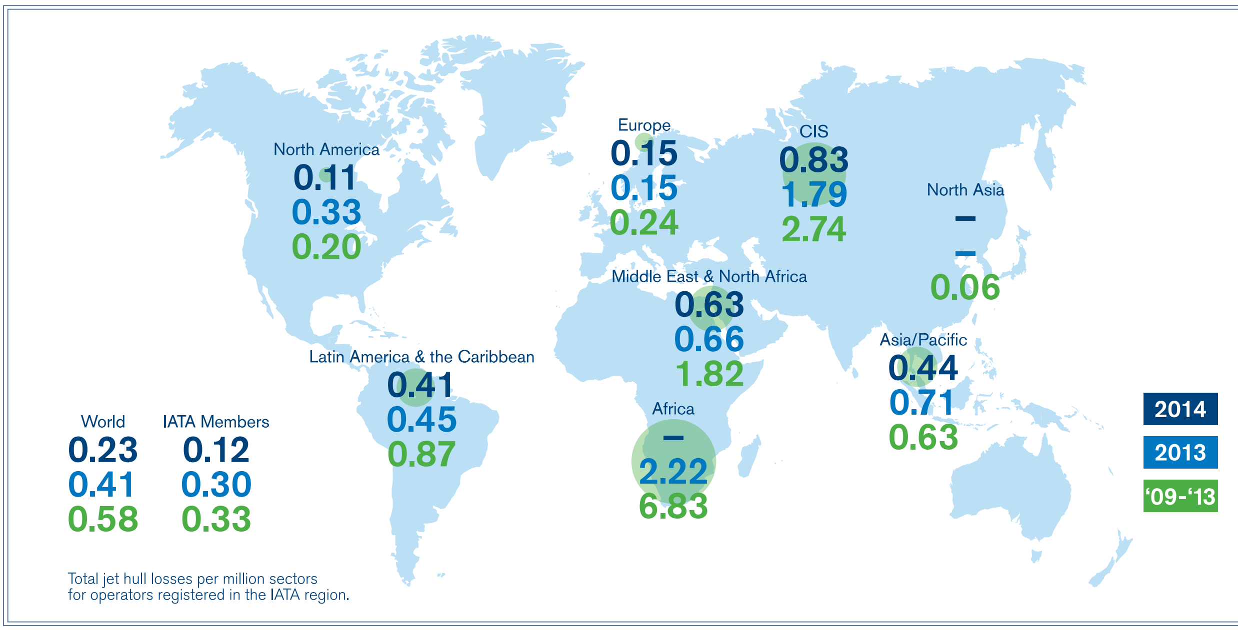
AIRCRAFT ACCIDENTS PER REGION

To calculate regional accident rates, IATA determines the accident region based on the operator's country. Moreover, the operator's country is specified in the operator's Air Operator Certificate (AOC).

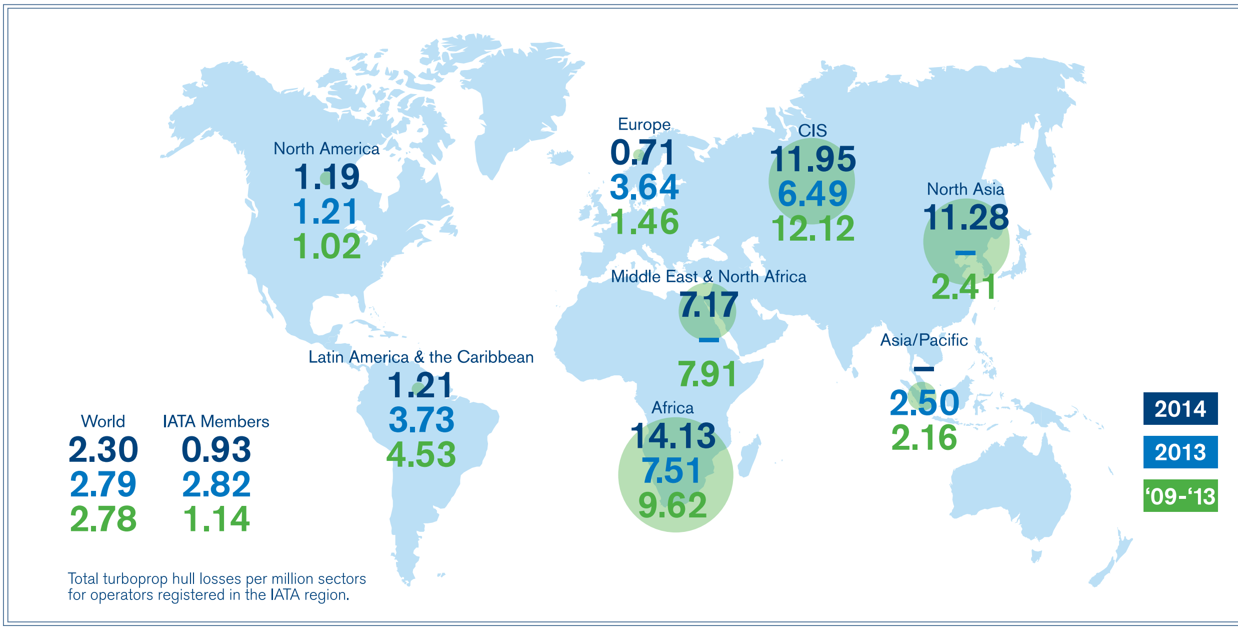
For example, if a Canadian-registered operator has an accident in Europe, this accident is counted as a "North American" accident as far as regional accident rates are concerned.

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

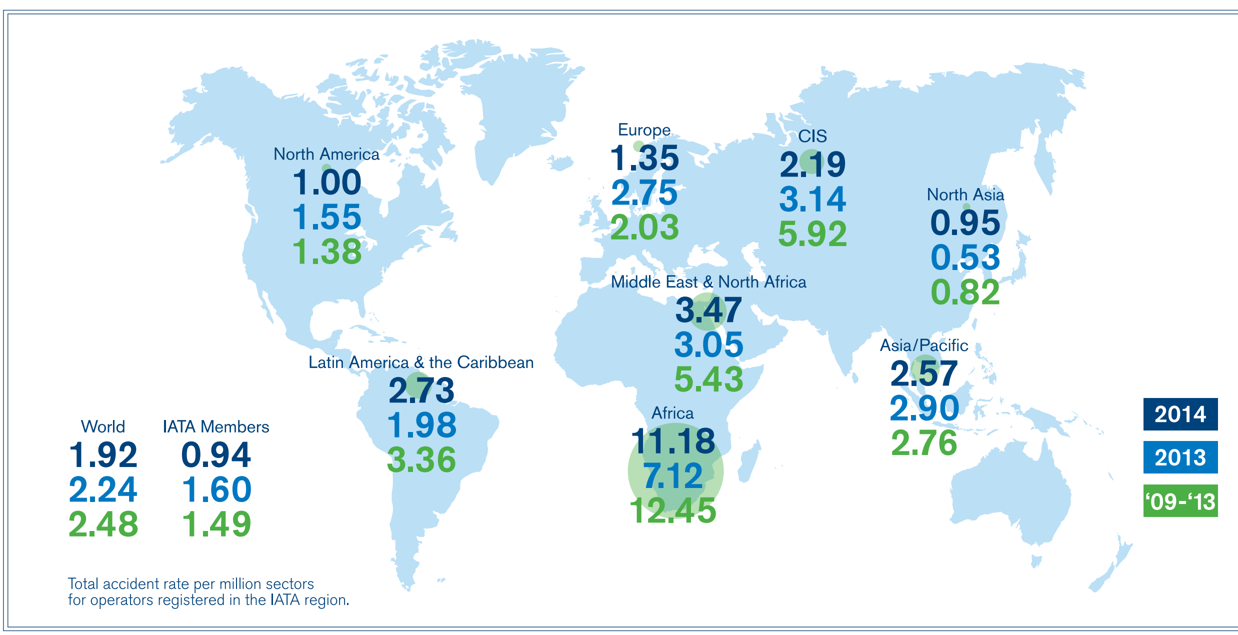
Total Jet Aircraft Hull Loss Rate by IATA Region



Total Turboprop Aircraft Hull Loss Rate by IATA Region



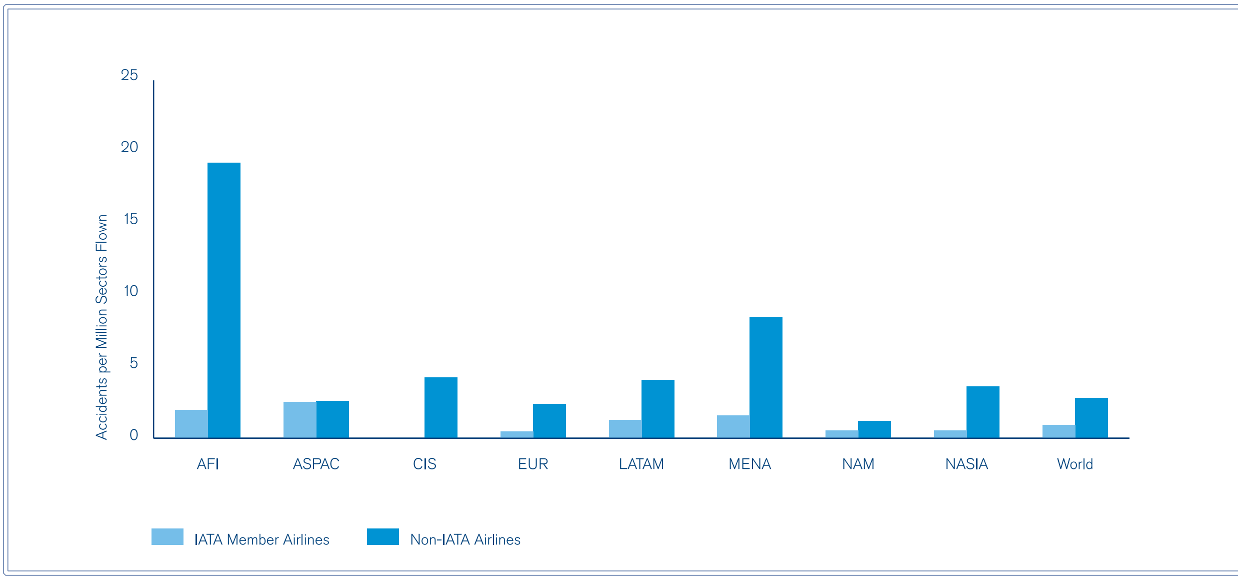
Total Accident Rate by IATA Region



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. The IATA member accident rate was three times less than for non-members in 2014.

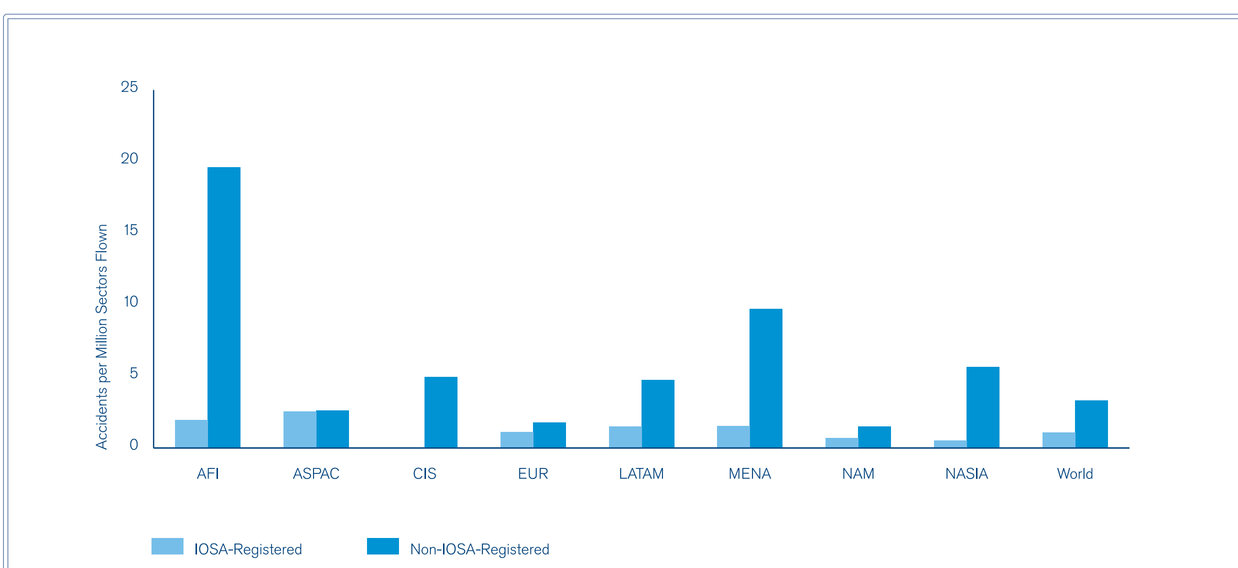
2014 Accident Rate: IATA Member Airlines vs. Non-Members



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-IOSA in every region. The IOSA-registered airline accident rate was three times lower than for non-IOSA airlines in 2014.

2014 Accident Rate: IOSA-Registered Airlines vs. Non-IOSA




3.3 Billion
passengers every year
49,871
routes
100,000
flights every day
Safety is aviation's top priority.
However, incidents and accidents do sometimes happen.

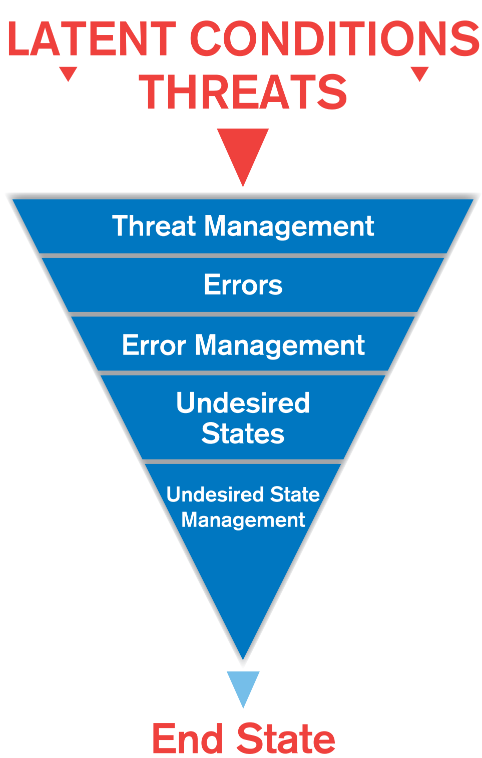
Section 4

In-Depth Accident Analysis 2010 to 2014

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.

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 page. 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 countermeasures 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

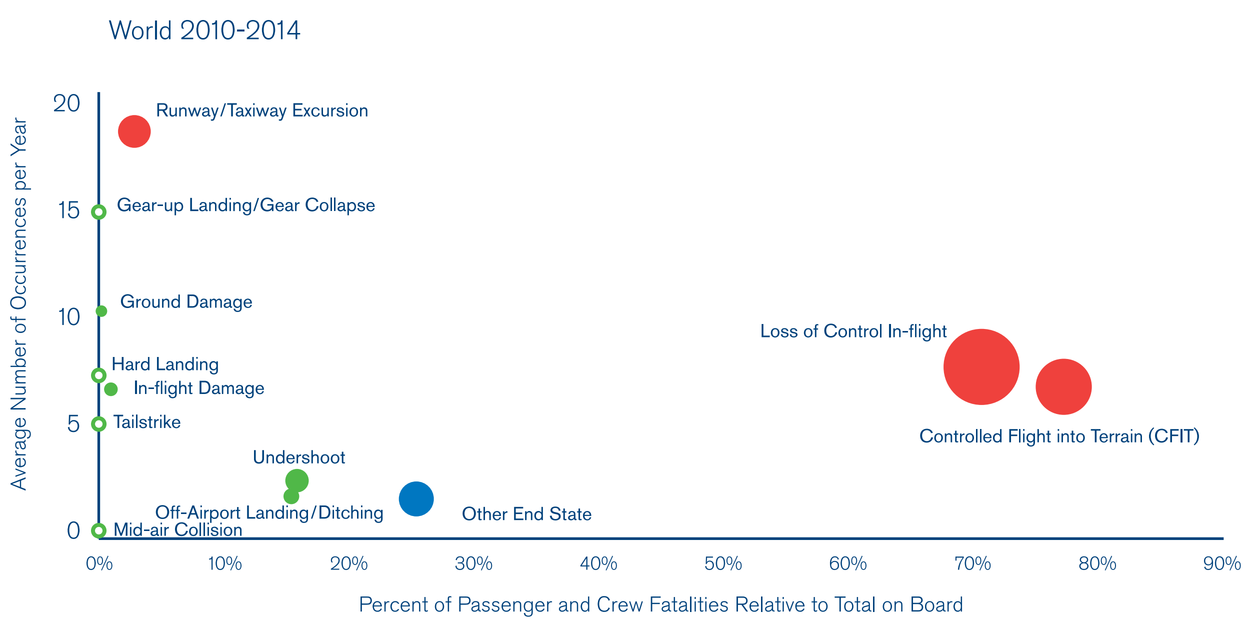
- This section presents an in-depth analysis of 2010 to 2014 occurrences by accident category
- Definitions of these categories can be found in **Annex 2**

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

ACCIDENT FREQUENCY AND SURVIVABILITY

Last year's report introduced a survivability analysis of different accident categories in order to identify the categories with higher or lower risk. The chart below shows the 2010-2014 data where each accident category is plotted by the average number of occurrences per year and the percentage of fatalities relative to the total number of people on board. The bubble size increases as the absolute number of fatalities for the category increases; empty bubbles indicate no fatalities for that accident category. Loss of Control In-flight, Controlled Flight into Terrain and Runway Excursions continue to be the top three high-risk categories to continually be addressed by the industry.



Note: Circle size increases as total fatalities increase; circles with white centers indicate no fatalities.

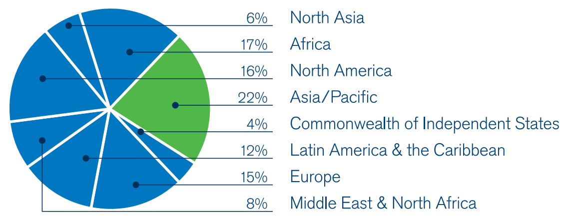
2014 Aircraft Accidents

73 Accidents

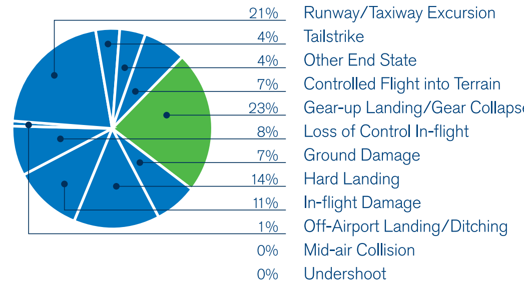
IATA Members	**23%**
Hull Losses	**33%**
Fatal	**16%**

74% Passenger | **25%** Cargo | **1%** Ferry | **53%** Jet | **47%** Turboprop

Breakdown per Operator Region

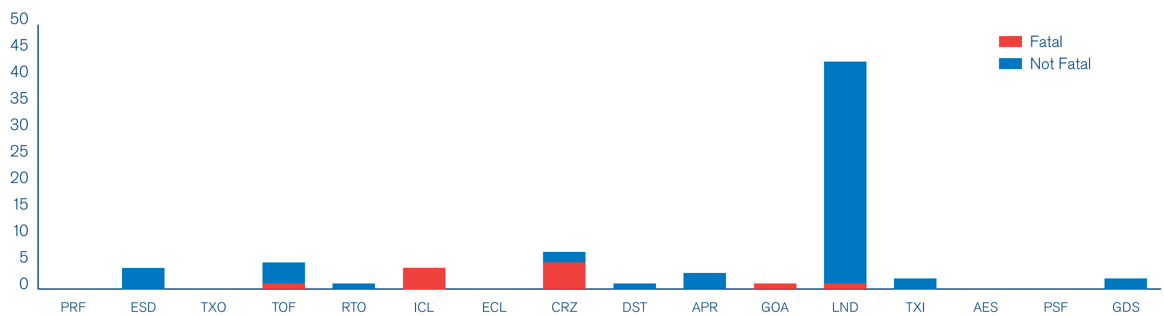


Breakdown per Accident Category



Accidents per Phase of Flight

See Annex 1 for detailed "Phase of Flight" definitions



Top Contributing Factors, 2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

- **23%** Regulatory oversight
- **13%** Flight operations: Training systems
- **12%** Safety Management
- **8%** Maintenance operations: SOPs & checking
- **8%** Design

Threats

Environmental

- **31%** Meteorology:
  - Poor visibility/IMC (56%*of these cases)
  - Wind/wind shear/gusty wind (44%* of these cases)
  - Thunderstorms (31%* of these cases)
- **15%** Lack of Visual Reference
- **8%** Terrain/Obstacles

Airline

- **27%** Aircraft malfunction:
  - Gear/tire (86% of all malfunctions)
  - Contained Engine Failure/ Powerplant Malfunction (14% of all malfunctions)
- **12%** Maintenance events
- **4%** Ground events

Flight Crew Errors (relating to…)

- **31%** Manual handling/flight controls
- **25%** SOP adherence/cross-verification
  - Intentional non-compliance (54% of these cases)
  - Unintentional non-compliance (38% of these cases)
- **10%** Callouts

Undesired Aircraft States

- **29%** Long/floated/bounced/ firm/off-centerline/ crabbed landing
- **13%** Vertical, lateral or speed deviations
- **12%** Unnecessary Weather Penetration
- **10%** Operation Outside Aircraft Limitations
- **8%** Abrupt Aircraft Control

Countermeasures

- **21%** Overall crew performance
- **17%** Monitor/cross-check
- **8%** Contingency management
- **8%** Leadership

Additional Classifications

- **29%** Insufficient data for contributing factors

Relationships of Interest, 2014

In **38%** of the jet aircraft accidents, metereology was a known contributing factor, whereas the turboprop rate stood at **20%**. Improved monitoring or cross-checking by the crew was seen as capable of preventing **56%** of these accidents.

Of the 17 gear-up landing/gear collapse accidents, **24%** presented inadequate adherence to SOP and cross-checking.

All of the 4 accidents during initial climb were fatal, with 3 controlled flight into terrain and 1 loss of control in flight. All were on turboprop cargo aircraft.

Note: 21 accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.

** The sum of the percentages may exceed 100% due to multiple contributing factors.*

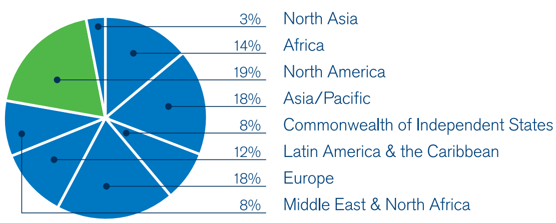
2010-2014 Aircraft Accidents

415 Accidents

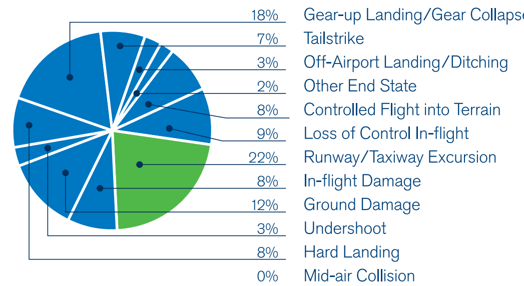
IATA Members	**28%**
Hull Losses	**41%**
Fatal	**21%**

78% Passenger	**19%** Cargo	**3%** Ferry	**53%** Jet	**47%** Turboprop

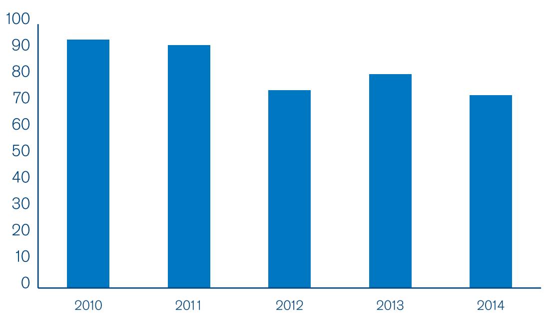
Breakdown per Operator Region



Breakdown per Accident Category

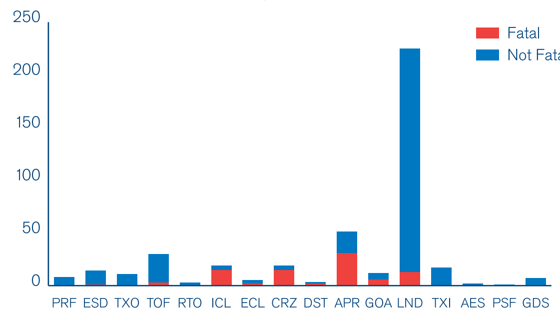


Accidents per Year



Accidents per Phase of Flight

See Annex 1 for detailed "Phase of Flight" definitions



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

27% Regulatory oversight
20% Safety management
13% Flight operations: Training systems
7% Maintenance operations: SOPs & checking
7% Flight operations: SOPs & checking

Threats

Environmental
28% Meteorology:
Wind/wind shear/gusty wind (51%* of these cases)
Poor visibility/IMC (40%* of these cases)
Thunderstorms (22%* of these cases)
13% Airport facilities
12% Ground-based navigation aids malfunctioning or not available

Airline
29% Aircraft malfunction:
Gear/tire (48% of all malfunctions)
Contained engine failure/powerplant malfunction (18% of all malfunctions)
10% Maintenance events
5% Ground events

Flight Crew Errors (relating to…)

26% Manual handling/flight controls
23% SOP adherence/cross-verification
Intentional non-compliance (66% of these cases)
Unintentional non-compliance (32% of these cases)
8% Failure to go around after destabilization during approach

Undesired Aircraft States

20% Long/floated/bounced/firm/off-centerline/crabbed landing
17% Vertical, lateral or speed deviations
9% Unstable approach
8% Continued landing after unstable approach
7% Operation outside aircraft limitations

Countermeasures

22% Overall crew performance
15% Monitor/cross-check
9% Contingency management
7% Leadership

Additional Classifications

18% Insufficient data for contributing factors

Relationships of Interest, 2010-2014

In **57%** of the accidents that involved deficiencies in regulatory oversight, inadequate safety management at the airline level was also present. Of these, failure to adhere to SOP, general manual handling of the aircraft and failure to go around after an unstable approach were the top 3 flight crew errors, with **42%**, **37%** and **16%** respectively.

In **57%** of the accidents in the cruise phase of flight, meteorology was considered a contributing factor. In **36%** of these accidents, an aircraft malfunction was also present. Fatalities occurred in **79%** of the accidents. Of the runway excursions involving a long, floated, bounced, firm, off-center or crabbed landing, **67%** involved deficiencies in general manual handling of the aircraft. Meteorologic factors were also present in **46%** of the accidents.

Note: 73 accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

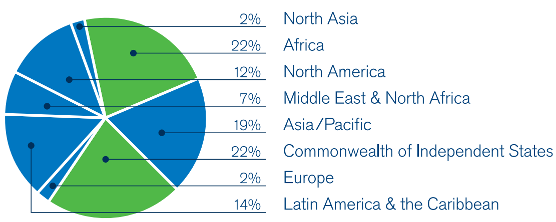
2010-2014 Fatal Aircraft Accidents

88 Accidents

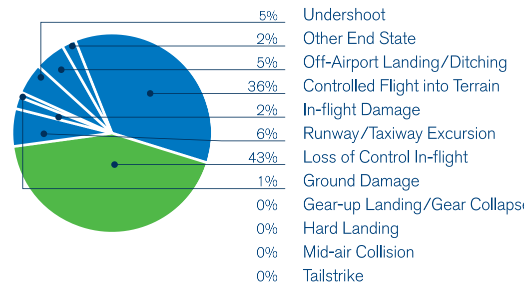
IATA Members	14%
Hull Losses	100%

65% Passenger | **32%** Cargo | **3%** Ferry | **37.5%** Jet | **62.5%** Turboprop

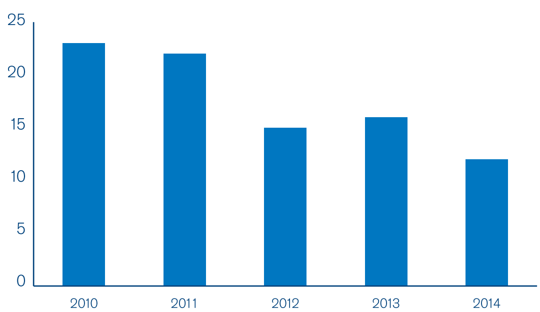
Breakdown per Operator Region



Breakdown per Accident Category

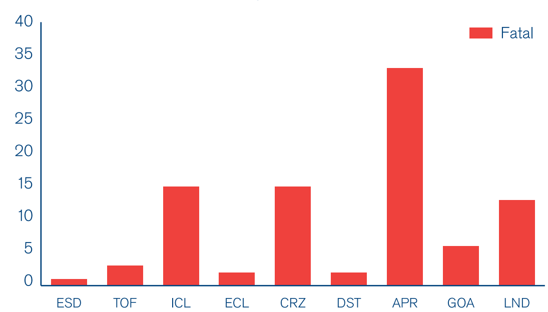


Accidents per Year



Accidents per Phase of Flight

See Annex 1 for detailed "Phase of Flight" definitions



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

- **42%** Regulatory oversight
- **34%** Safety management
- **23%** Technology and equipment
- **20%** Flight operations: training systems
- **15%** Flight operations: SOPs & checking

Threats

Environmental

- **45%** Meteorology:
  - Poor visibility/IMC (66%* of these cases)
  - Thunderstorms (25%* of these cases)
  - Wind/wind shear/gusty wind (19%* of these cases)
- **28%** Ground-based navigation aids malfunctioning or not available
- **13%** Lack of visual reference

Airline

- **28%** Aircraft malfunction:
  - Contained engine failure/powerplant malfunction (50% of all malfunctions)
  - Fire/smoke (cockpit/cabin/cargo) (30% of all malfunctions)
- **6%** Maintenance events
- **6%** Operational pressure

Flight Crew Errors (relating to…)

- **37%** SOP adherence/cross-verification
  - Intentional non-compliance (69% of these cases)
  - Unintentional non-compliance (31% of these cases)
- **25%** Manual handling/flight controls
- **11%** Callouts

Undesired Aircraft States

- **31%** Vertical, lateral or speed deviations
- **18%** Controlled flight towards terrain
- **14%** Unnecessary weather penetration
- **11%** Unstable approach
- **10%** Operation outside of aircraft limitations

Countermeasures

- **38%** Overall crew performance
- **27%** Monitor/cross-check
- **14%** Leadership
- **13%** Contingency management

Additional Classifications

- **19%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Of the accidents involving vertical, lateral or speed deviation, **72%** were on approach. Of these, **56%** involved malfunction or lack of ground-based nav-aid equipment, **50%** involved poor visibility, **69%** involved non-adherence to SOP and inadequate cross-verification and **38%** involved unecessary weather penetration.

In the accidents where leadership was considered as an attitude that could have prevented the accident, **100%** contained non-adherence to SOP and cross-verification, **60%** involved pilot-to-pilot communication, **50%** involved lack of general manual handling of the aircraft and **40%** callouts that were ommitted.

Note: 17 accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
**The sum of the percentages may exceed 100% due to multiple contributing factors*

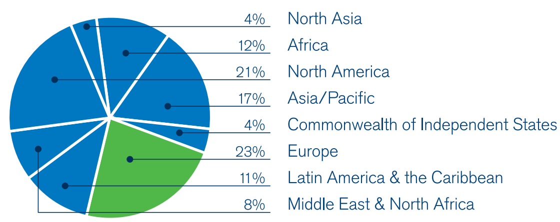
2010-2014
Non-Fatal Aircraft Accidents

327 Accidents

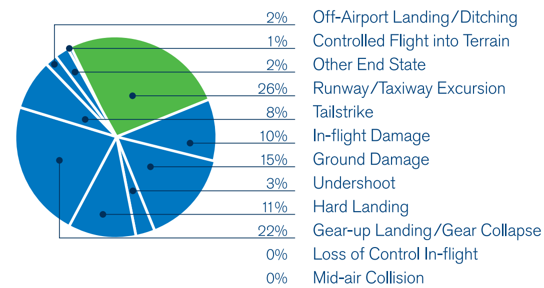
IATA Members	32%
Hull Losses	25%

81% Passenger	**16%** Cargo	**3%** Ferry	**57%** Jet	**43%** Turboprop

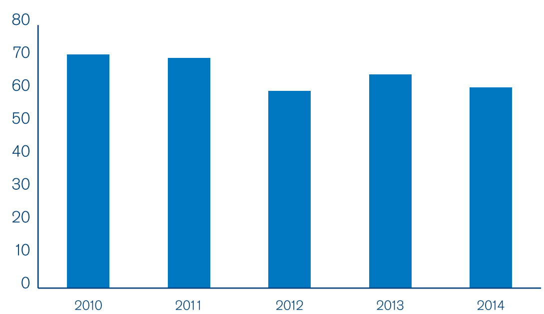
Breakdown per Operator Region



Breakdown per Accident Category

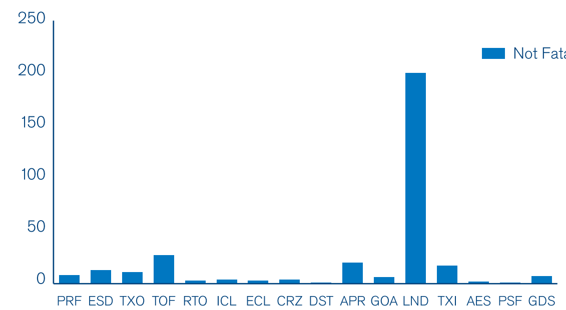


Accidents per Year



Accidents per Phase of Flight

See Annex 1 for detailed "Phase of Flight" definitions



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

23% Regulatory oversight
16% Safety management
11% Flight operations: training systems
8% Maintenance operations: SOPs & checking
6% Design

Threats

Environmental
23% Meteorology:
Wind/wind shear/gusty wind (67%* of these cases)
Poor visibility/IMC (27%* of these cases)
Thunderstorms (21%* of these cases)
16% Airport facilities
7% Ground-based navigation aids malfunctioning or not available

Airline
29% Aircraft malfunction:
Gear/tire (59% of all malfunctions)
Contained engine failure/powerplant malfunction (10% of all malfunctions)
11% Maintenance events
7% Ground events

Flight Crew Errors (relating to…)

27% Manual handling/flight controls
19% SOP adherence/cross-verification
Intentional non-compliance (65% of these cases)
Unintentional non-compliance (33% of these cases)
9% Failure to go around after destabilization during approach

Undesired Aircraft States

24% Long/floated/bounced/firm/off-centerline/crabbed landing
13% Vertical, lateral or speed deviations
9% Unstable approach
8% Continued landing after unstable approach
7% Loss of aircraft control while on the ground

Countermeasures

18% Overall crew performance
13% Monitor/cross-check
8% Contingency management
6% Leadership

Additional Classifications

17% Insufficient data for contributing factors

Relationships of Interest, 2010-2014

In accidents that uncovered signs of weak safety management systems at the airline level, **25%** also showed signs of inefficient training. Of these, **76%** involved errors in manual handling of the aircraft, **64%** resulted in a long, floated, bounced, firm, off-centered or crabbed landing. Improved monitoring and cross-checking were noted as methods to help prevent **48%** of these accidents.

Of the accidents involving deficient regulatory oversight, **27%** were related to deficiencies in airport facilities and **19%** involved poor braking action related to a contaminated runway.

Note: 56 non-fatal accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
**The sum of the percentages may exceed 100% due to multiple contributing factors*

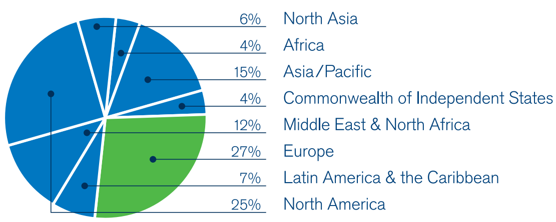
2010-2014 IOSA Aircraft Accidents

165 Accidents

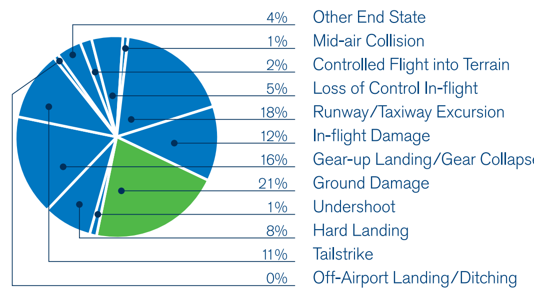
IATA Members	**71%**
Hull Losses	**17%**
Fatal	**9%**

88% Passenger	**10%** Cargo	**2%** Ferry	**80%** Jet	**20%** Turboprop

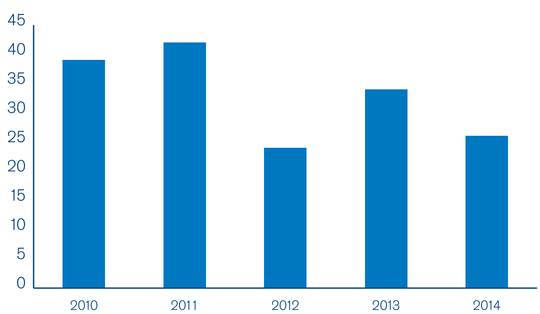
Breakdown per Operator Region



Breakdown per Accident Category

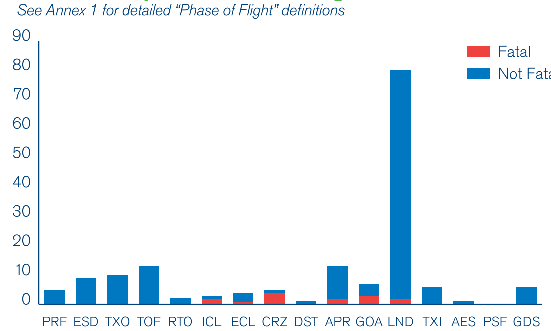


Accidents per Year



Accidents per Phase of Flight

See Annex 1 for detailed "Phase of Flight" definitions



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

- **13%** Regulatory oversight
- **12%** Flight operations: training systems
- **9%** Maintenance operations: SOPs & checking
- **9%** Design
- **7%** Safety management

Threats

Environmental

- **23%** Meteorology:
  - Wind/wind shear/gusty wind (62%* of these cases)
  - Thunderstorms (24%* of these cases)
  - Poor visibility/IMC (18%* of these cases)
- **13%** Airport facilities
- **9%** Air traffic services

Airline

- **30%** Aircraft malfunction:
  - Gear/tire (58% of all malfunctions)
  - Fire/smoke (cockpit/cabin/cargo) (16% of all malfunctions)
- **14%** Maintenance events
- **8%** Ground events

Flight Crew Errors (relating to…)

- **23%** Manual handling/flight controls
- **18%** SOP adherence/cross-verification
  - Unintentional non-compliance (52% of these cases)
  - Intentional non-compliance (48% of these cases)
- **7%** Failure to go around after destabilization during approach

Undesired Aircraft States

- **21%** Long/floated/bounced/firm/off-centerline/crabbed landing
- **11%** Vertical, lateral or speed deviations
- **9%** Unstable approach
- **7%** Operation outside of aircraft limitations
- **6%** Loss of aircraft control while on the ground

Countermeasures

- **16%** Overall crew performance
- **13%** Monitor/cross-check
- **8%** Contingency management
- **7%** Leadership

Additional Classifications

- **10%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

In **46%** of the fatal accidents, deficient oversight by the regulatory authority was present. Of these, **33%** were also related to a malfunction or lack of ground-based nav-aid equipment.

28% of the fatal accidents occured when the aircraft was on the cruise phase of flight. Of these, **33%** encountered icing conditions and thunderstorms.

Non-adherence to SOP and SOP cross-verification were noted in **67%** of the accidents that occurred on initial climb, **25%** of the ones on cruise, **14%** on go-around, **8%** on approach and **3%** on the landing phase of flight.

Note: 16 accidents involving IOSA registered airlines were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.

**The sum of the percentages may exceed 100% due to multiple contributing factors*

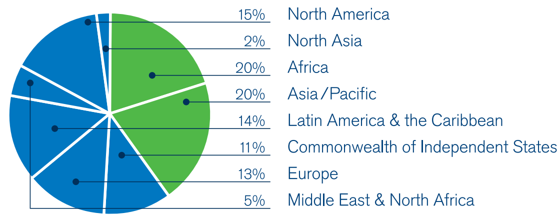
2010-2014
Non-IOSA Aircraft Accidents

250 Accidents

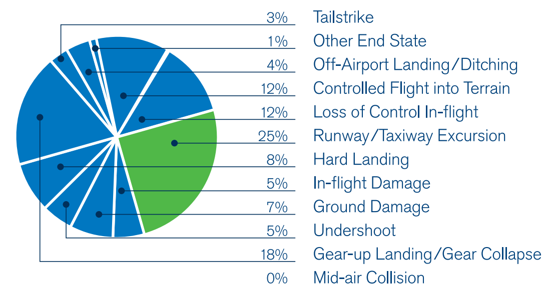
IATA Members	0%
Hull Losses	57%
Fatal	30%

71% Passenger	26% Cargo	3% Ferry	35% Jet	65% Turboprop

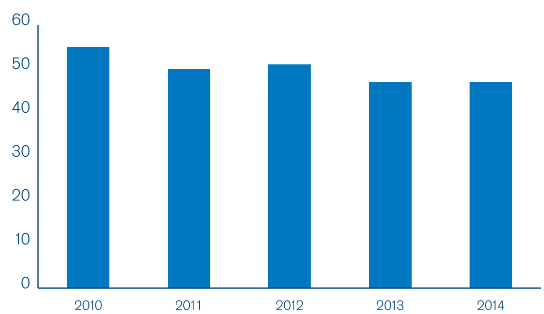
Breakdown per Operator Region



Breakdown per Accident Category

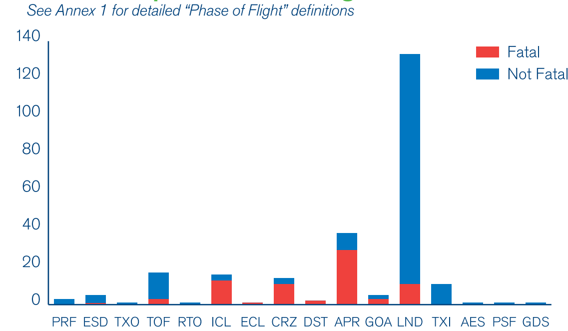


Accidents per Year



Accidents per Phase of Flight

See Annex 1 for detailed "Phase of Flight" definitions



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

38% Regulatory oversight
29% Safety management
14% Flight operations: training systems
11% Flight operations: SOPs & checking
9% Technology & equipment

Threats

Environmental
32% Meteorology:
Poor visibility/IMC (52%* of these cases)
Wind/wind shear/gusty wind (44%* of these cases)
Thunderstorms (21%* of these cases)
16% Ground-based navigation aids malfunctioning or not available
12% Airport facilities

Airline
27% Aircraft malfunction:
Gear/tire (40% of all malfunctions)
Contained engine failure/powerplant malfunction (26% of all malfunctions)
7% Maintenance events
3% Operational pressure

Flight Crew Errors (relating to…)

28% Manual handling/flight controls
26% SOP adherence/cross-verification
Intentional non-compliance (74% of these cases)
Unintentional non-compliance (24% of these cases)
9% Failure to go around after destabilization during approach

Undesired Aircraft States

22% Vertical, lateral or speed deviations
19% Long/floated/bounced/firm/off-centerline/crabbed landing
10% Unstable approach
9% Continued landing after unstable approach
6% Controlled flight towards terrain

Countermeasures

26% Overall crew performance
17% Monitor/cross-check
10% Contingency management
7% Captain should show leadership

Additional Classifications

23% Insufficient data for contributing factors

Relationships of Interest, 2010-2014

In **41%** of the fatal accidents, deficient oversight by the regulatory authority was present. Of these, **29%** were also related to a malfunction or lack of ground-based nav-aid equipment.

39% of the fatal accidents occured when the aircraft was on the approach phase of flight. Of these, **46%** involved a malfunction or lack of ground-based nav-aid equipment and **42%** involved poor visibility.

Non-adherence to SOP and SOP cross-verification were noted in **15%** of the accidents that occurred on initial climb, **10%** of the ones on cruise, **20%** on go-around, **42%** on approach and **2%** on the landing phase of flight.

Note: 57 accidents involving non-IOSA registered airlines were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
**The sum of the percentages may exceed 100% due to multiple contributing factors*

Controlled Flight into Terrain

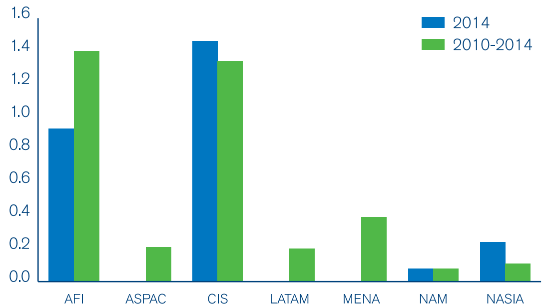
2014 — 5 Accidents
2010-2014 — 34 Accidents

	2014	'10-'14
IATA Members	20%	12%
Hull Losses	100%	100%
Fatal	80%	91%
Accident Rate	0.13	0.19

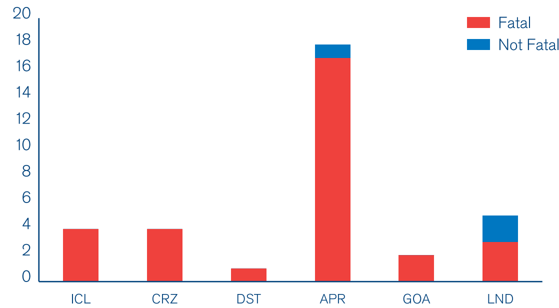
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	20%	80%	0%	0%	100%
2010-2014	59%	35%	6%	32%	68%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

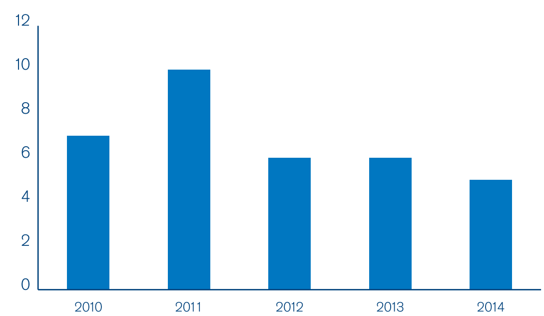


Accidents per Phase of Flight, 2010-2014



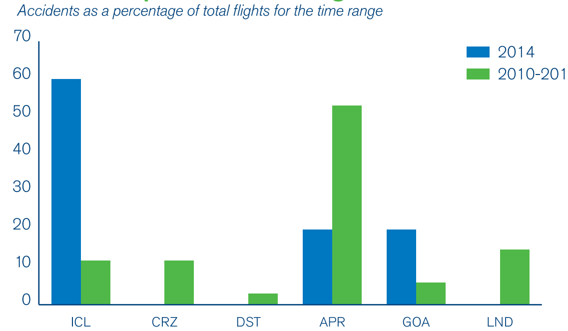
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

70% Regulatory oversight
59% Technology and equipment
41% Safety management
19% Flight operations: Training systems
15% Flight operations: SOPs & checking

Threats

Environmental

28% Meteorology:
Poor visibility/IMC
(87%* of these cases)
Wind/wind shear/gusty wind
(13%* of these cases)
Thunderstorms (13%* of these cases)

Threats
(cont'd)

52% Ground-based navigation aids malfunctioning or not available
22% Terrain/obstacles

Airline

4% Maintenance events
4% Aircraft malfunction:
Avionics/flight Instruments
(100% of all malfunctions)
Autopilot/FMS
(100% of all malfunctions)
4% Operational pressure

Flight Crew Errors
(relating to…)

48% SOP adherence/SOP cross-verification:
Intentional non-compliance
(69% of these cases)
Unintentional non-compliance
(31% of these cases)
19% Callouts
19% Manual handling/flight controls

Undesired Aircraft States

52% Vertical, lateral or speed deviations
15% Unnecessary weather penetration
7% Unstable approach
4% Continued landing after unstable approach

Countermeasures

48% Monitor/cross-check
44% Overall crew performance
15% Automation management
15% Communication environment

Additional Classifications

21% Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Vertical, lateral or speed deviations were present in **79%** of the accidents that occurred in the approach phase of flight. Of these, **50%** also occurred in the presence of a malfunctioning or non-existing ground-based nav-aid equipment and **64%** involved non-adherence to SOP by the flight crew. Improved monitoring and cross-checking were found to be methods that could have prevented **41%** of the accidents, while a better display of leadership could have positively affected **32%** of the accidents.

73% of the jet CFIT accidents occurred in poor visibility conditions, while the turboprop rate stood at **32%**. **75%** of the turboprop CFIT accidents involved aircraft with no safety equipment installed, such as E-GPWS, or predictive wind-shear. The jet rate stood at **37%**.

Note: 7 CFIT accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

Loss of Control In-flight

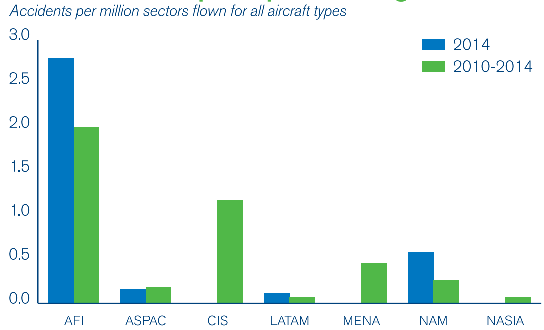
2014	6 Accidents
2010-2014	38 Accidents

	2014	'10-'14
IATA Members	0%	13%
Hull Losses	100%	97%
Fatal	100%	97%
Accident Rate	0.16	0.21

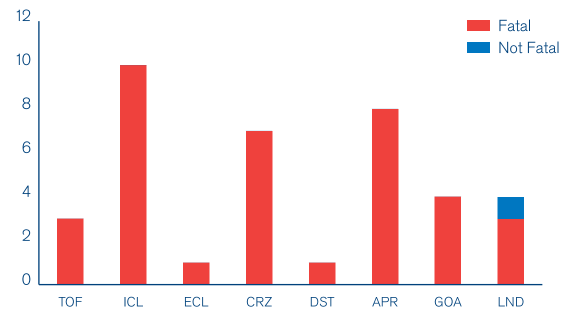
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	50%	50%	0%	33%	67%
2010-2014	68%	32%	0%	34%	66%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

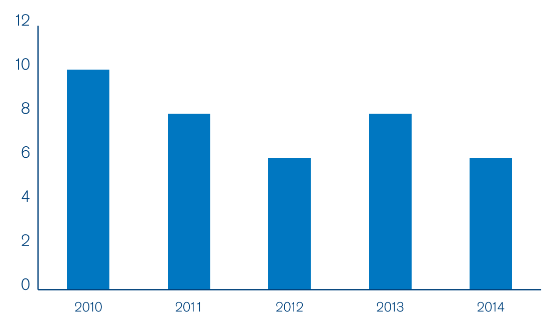


Accidents per Phase of Flight, 2010-2014



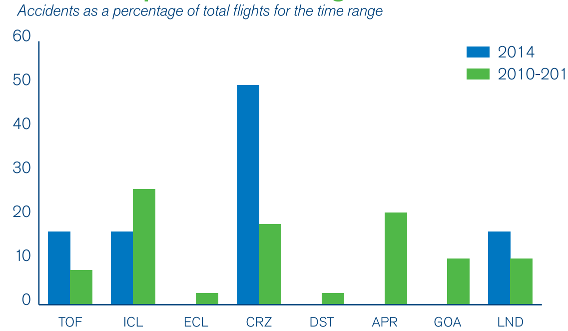
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

27% Safety management
21% Flight operations: Training systems
21% Regulatory oversight
15% Flight operations: SOPs & checking
12% Selection systems

Threats

Environmental

42% Meteorology:
Icing conditions (36%* of these cases)
Poor visibility/IMC (36%* of these cases)
Thunderstorms (36%* of these cases)

Threats
(cont'd)

12% Lack of visual reference
9% Ground-based navigation aids malfunctioning or not available

Airline

42% Aircraft malfunction:
Contained engine failure/powerplant malfunction
(64% of all malfunctions)
Fire/smoke (cockpit/cabin/cargo) (14% of all malfunctions)
9% Operational pressure
6% Maintenance events

Flight Crew Errors
(relating to…)

33% Manual handling/flight controls
30% SOP adherence/SOP cross-verification:
Intentional non-compliance (60% of these cases)
Unintentional non-compliance (40% of these cases)
9% Callouts

Undesired Aircraft States

24% Vertical/lateral speed deviation
18% Operation outside aircraft limitations
18% Unnecessary weather penetration
12% Unstable approach
6% Abrupt aircraft control

Countermeasures

36% Overall crew performance
18% Contingency management
12% Captain should show leadership

Additional Classifications

13% Insufficient data for contributing factors

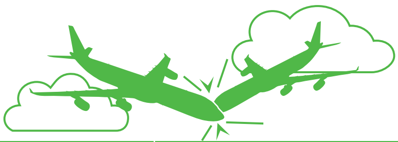
Relationships of Interest, 2010-2014

Contained engine failure or powerplant malfunction was present in **56%** of the accidents that occurred in the initial climb phase of flight, with **85%** having occurred on turboprop aircraft.

Improved communication between flight crew could have acted as a means of preventing **50%** of the LOC-I accidents that occurred in the ASPAC region.

Metereology was a contributing factor in **67%** of the LOC-I accidents that occurred in the LATAM region; for other regions the percent values were: **60%** in CIS, **50%** in ASPAC, **50%** in EUR, **33%** in NAM, **25%** in MENA and **22%** in AFI.**

Note: 5 LOC-I accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*
***While the rest of the report focuses on the region where the operator is registered, these numbers relate to the region where the accident occurred.*



Mid-Air Collision

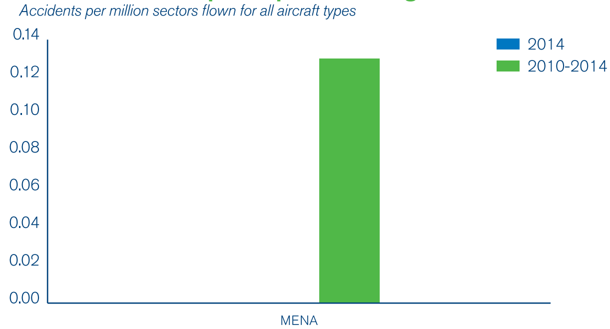
2014 0 Accident
2010-2014 1 Accident

	2014	'10-'14
IATA Members	N/A	100%
Hull Losses	N/A	0%
Fatal	N/A	0%
Accident Rate	N/A	0.01

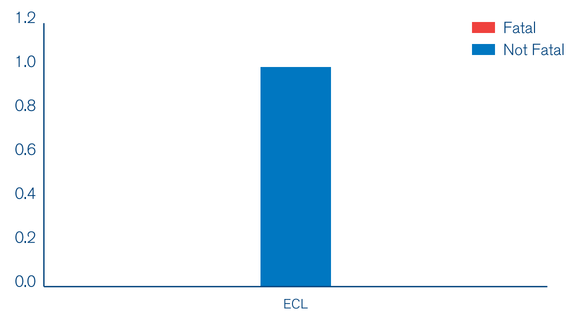
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	N/A	N/A	N/A	N/A	N/A
2010-2014	100%	0%	0%	100%	0%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

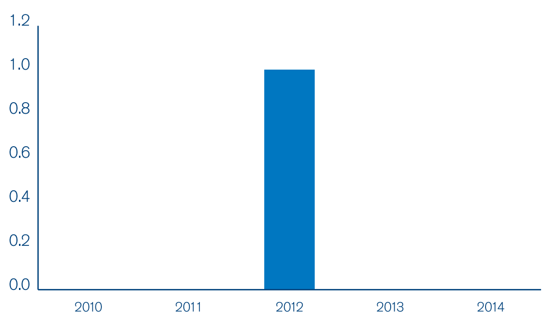


Accidents per Phase of Flight, 2010-2014



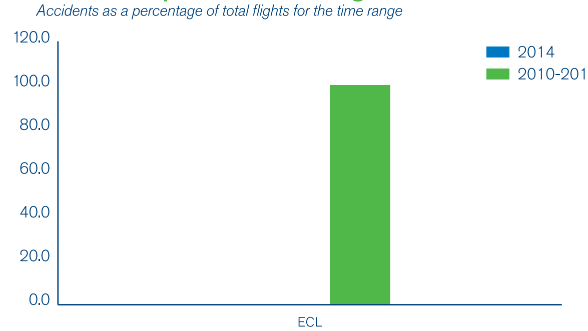
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

Note: Given that one accident does not provide a complete picture of the status of a category of accident, IATA will not publish contributing factors or relationships of interest.

Threats

Environmental

Airline

Flight Crew Errors
(relating to…)

Undesired Aircraft States

Countermeasures

Additional Classifications

Relationships of Interest, 2010-2014

Runway/Taxiway Excursion

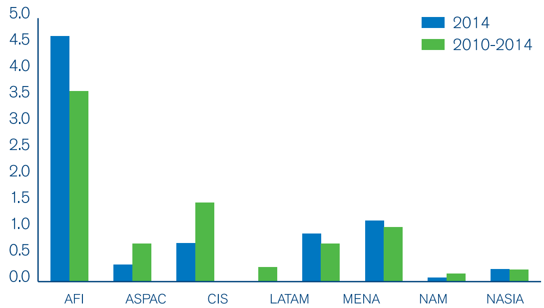
2014	15 Accidents
2010-2014	90 Accidents

	2014	'10-'14
IATA Members	13%	23%
Hull Losses	40%	42%
Fatal	0%	6%
Accident Rate	0.39	0.50

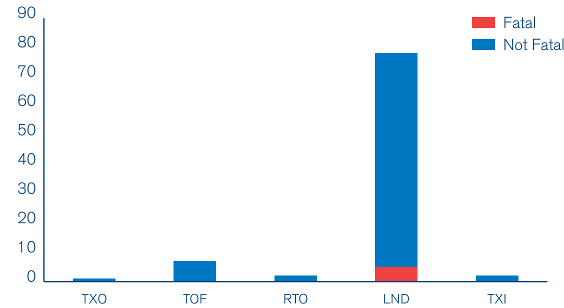
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	80%	20%	0%	53%	47%
2010-2014	85%	14%	1%	54%	46%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

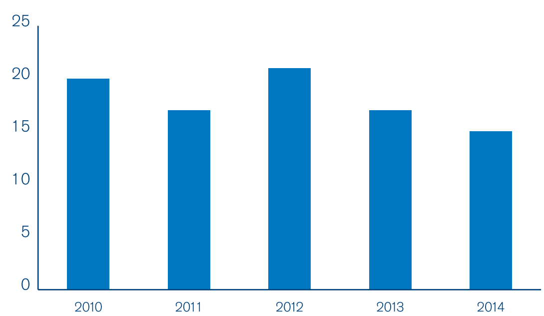


Accidents per Phase of Flight, 2010-2014



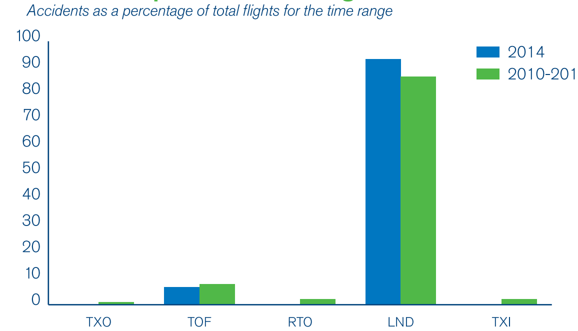
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

- **38%** Regulatory oversight
- **27%** Safety management
- **16%** Flight operations: Training systems
- **9%** Flight operations: SOPs & checking
- **4%** Maintenance operations: SOPs & checking

Threats

Environmental

- **43%** Meteorology:
  - Wind/windshear/gusty wind (50%* of these cases)
  - Poor visibility/IMC (38%* of these cases)
  - Thunderstorms (34%* of these cases)
- **41%** Airport facilities
- **16%** Ground-based navigation aids malfunctioning or not available

Airline

- **20%** Aircraft malfunction:
  - Brakes (27% of all malfunctions)
  - Contained engine failure/powerplant malfunction (27% of all malfunctions)
- **4%** Maintenance events

Flight Crew Errors (relating to…)

- **38%** Manual handling/flight controls
- **28%** SOP adherence/SOP cross-verification:
  - Intentional non-compliance (71% of these cases)
  - Unintentional non-compliance (24% of these cases)
- **22%** Failure to go around after destabilized approach

Undesired Aircraft States

- **50%** Long/floated/bounced/firm/off-center/crabbed landing
- **18%** Continued landing after unstable approach
- **18%** Loss of aircraft control while on the ground
- **16%** Vertical/lateral/speed deviation
- **16%** Unstable approach

Countermeasures

- **32%** Overall crew performance
- **24%** Monitor/cross-check
- **14%** Contingency management
- **14%** Taxiway/runway management

Additional Classifications

- **18%** Insufficient data for contributing factors

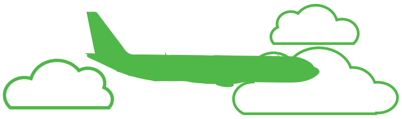
Relationships of Interest, 2010-2014

Deficiency in oversight by regulatory authority were present in **46%** of the turboprop accidents. The rate for jet aircraft was of **33%**.

Deficiency in the airline safety managent systems were present in **32%** of the turboprop accidents. The rate for jet aircraft was of **24%**.

Aircraft malfunction was a contributing factor in **20%** of jet and **21%** of turboprop aircraft accidents. Non-adherence to SOP and SOP cross-verification were contributing factors in **50%** of the accidents that occurred with operators from the CIS region; for other regions the percent values were: **47%** in ASPAC, **30%** in EUR, **29%** in MENA, **25%** in NAM, **15%** in AFI and **11%** in LATAM.

Note: 16 Runway Excursion accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*



In-flight Damage

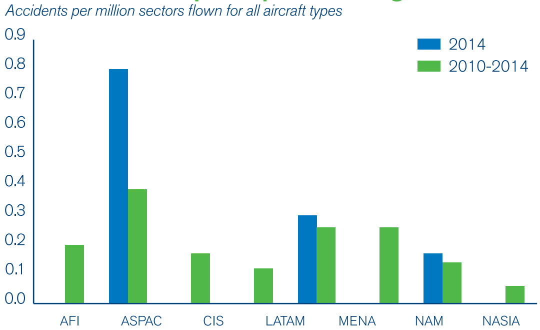
2014 8 Accidents
2010-2014 33 Accidents

	2014	'10-'14
IATA Members	25%	46%
Hull Losses	13%	15%
Fatal	0%	6%
Accident Rate	0.21	0.18

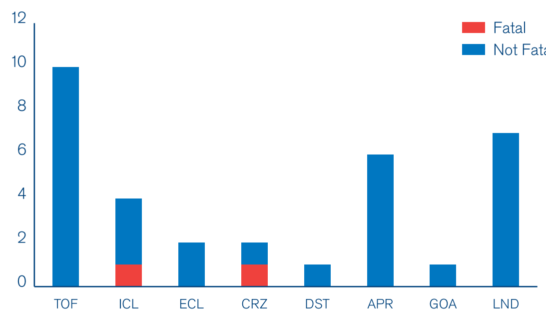
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	100%	0%	0%	50%	50%
2010-2014	79%	18%	3%	70%	30%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

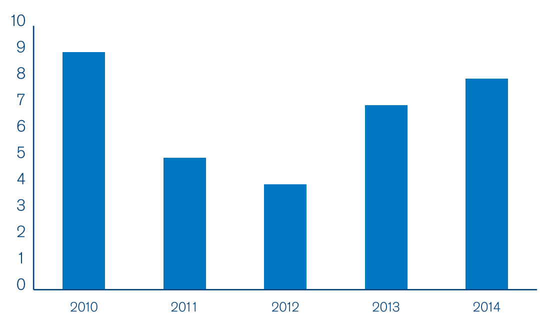


Accidents per Phase of Flight, 2010-2014



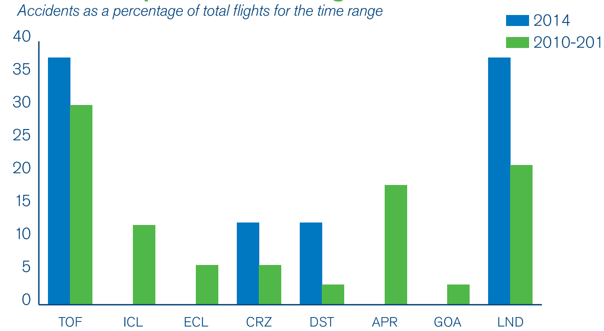
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

18% Regulatory oversight
15% Maintenance operations: SOPs & checking
9% Safety management
6% Design
3% Maintenance operations: Training systems

Threats
Environmental
36% Wildlife/birds/foreign object

Threats
(cont'd)

12% Meteorology:
Wind/windshear/gusty wind (75%* of these cases)
Poor visibility/IMC (50%* of these cases)
Thunderstorms (25%* of these cases)
12% Airport facilities

Airline
33% Aircraft malfunction:
Extensive/uncontained engine failure (55% of all malfunctions)
Fire/smoke (cockpit/cabin/cargo) (18% of all malfunctions)
21% Maintenance events
3% Dangerous goods

Flight Crew Errors
(relating to…)

12% SOP adherence/SOP cross-verification:
Intentional non-compliance (50% of these cases)
Unintentional non-compliance (25% of these cases)
6% Pilot-to-pilot communication
3% Automation

Undesired Aircraft States

12% Vertical, lateral or speed deviations
6% Abrupt aircraft control
6% Continued landing after unstable approach
6% Operation outside aircraft limitations
6% Unstable approach

Countermeasures

6% Automation management
6% Contingency management
6% Captain should show leadership

Additional Classifications

No additional classifications

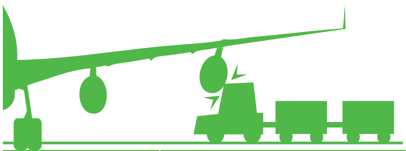
Relationships of Interest, 2010-2014

Bird or other wildlife collision caused **36%** of the in-flight damage accidents.

60% of the turboprop accidents involved collision with wildlife. For jet aircraft, the rate was of **26%**. Most of the contributing factors leading to the jet accidents involved some sort of aircraft malfunction - **39%**, and extensive or uncontained engine failure - **22%**.

The 2 accidents that involved fatalities occurred in the ASPAC region**.

Note: All accidents had sufficient information for classification.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*
***While the rest of the report focuses on the region where the operator is registered, these numbers relate to the region where the accident occurred.*



Ground Damage

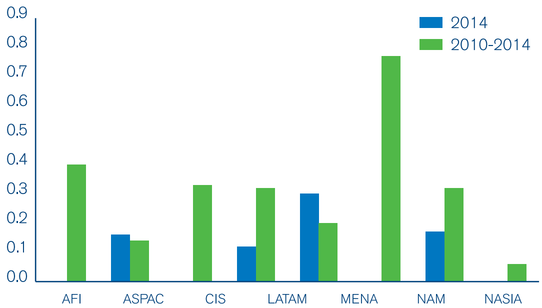
2014	5 Accidents
2010-2014	50 Accidents

	2014	'10-'14
IATA Members	60%	44%
Hull Losses	0%	10%
Fatal	0%	2%
Accident Rate	0.13	0.28

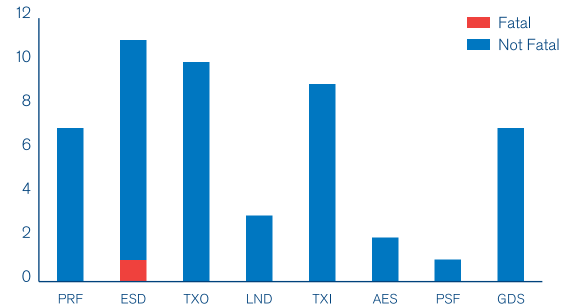
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	80%	20%	0%	100%	0%
2010-2014	92%	4%	4%	62%	38%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

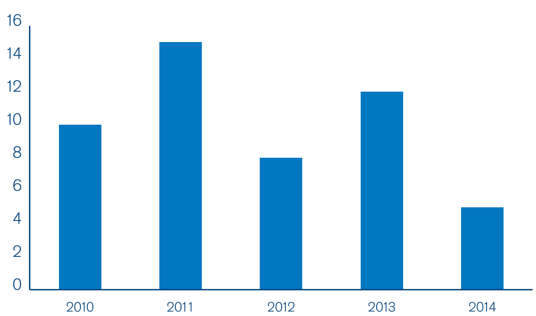


Accidents per Phase of Flight, 2010-2014



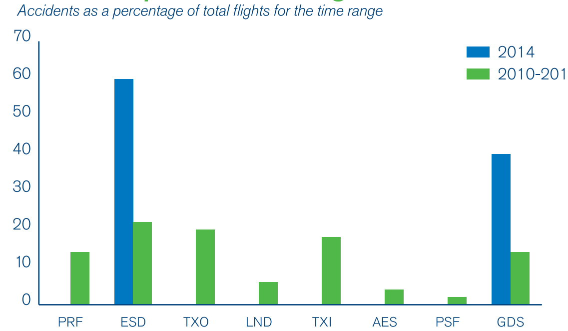
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

- **16%** Regulatory oversight
- **9%** Ground operations
- **7%** Ground operations: SOPs & checking
- **7%** Safety management
- **2%** Flight operations: SOPs & checking

Threats

Environmental
- **16%** Air traffic services
- **16%** Airport facilities
- **9%** Traffic

Airline
- **40%** Ground events:
- **14%** Aircraft malfunction:
  Fire/smoke (cockpit/cabin/cargo) (83%* of these cases)
  Brakes (17%* of these cases)
- **2%** Manuals/charts/checklists

Flight Crew Errors (relating to…)

- **12%** SOP adherence/SOP cross-verification:
  Intentional non-compliance (60% of these cases)
  Unintentional non-compliance (40% of these cases)
- **9%** Crew to external communications errors
- **7%** Ground crew

Undesired Aircraft States

- **19%** Ramp movements
- **9%** Loss of aircraft control while on the ground
- **5%** Wrong taxiway/ramp/gate/hold spot
- **2%** Brakes/thrust reversers/ground spoilers
- **2%** Engine

Countermeasures

- **12%** Overall crew performance
- **12%** Taxiway/runway management
- **7%** Monitor/cross-check
- **2%** First Officer is assertive when necessary

Additional Classifications

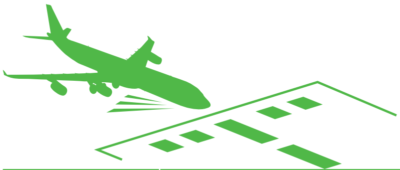
- **14%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Non-adherence to SOP by ground operations was a contributing factor in **17%** of the accidents involving ground events.

38% of the accidents involving ramp movement also involved deficiencies in the air traffic services provided. Poor or faint markings or signs, or closure of runway/taxiway were noted in **25%** of these accidents.

Note: 7 Ground Damage accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*



Undershoot

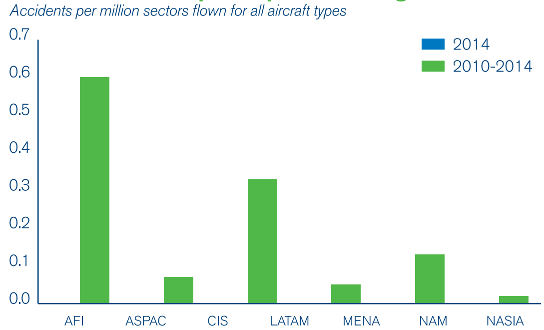
2014 — 0 Accidents
2010-2014 — 12 Accidents

	2014	'10-'14
IATA Members	0%	8%
Hull Losses	0%	83%
Fatal	0%	33%
Accident Rate	0.00	0.07

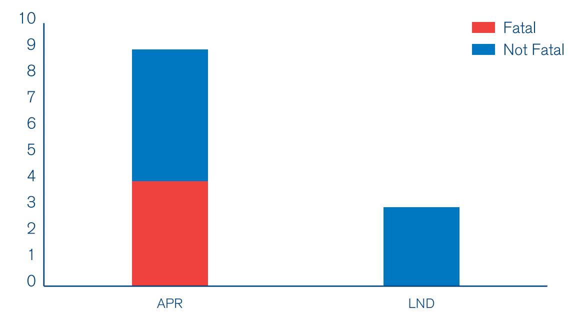
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	0%	0%	0%	0%	0%
2010-2014	75%	25%	0%	67%	33%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

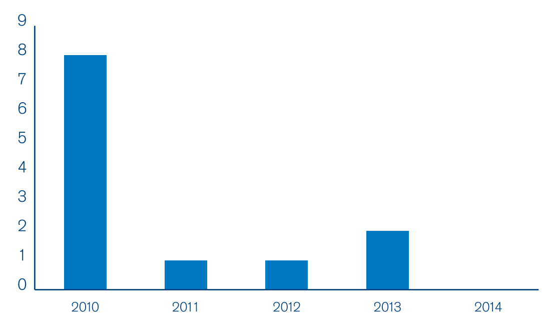


Accidents per Phase of Flight, 2010-2014



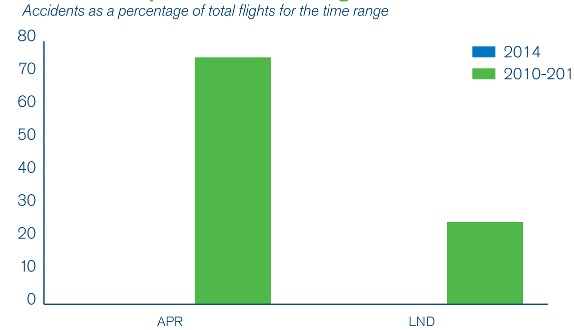
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

58% Regulatory oversight
58% Safety management
25% Flight operations: SOPs & checking
25% Flight operations: Training systems
25% Change management

Threats

Environmental
50% Ground-based nav aid malfunction or not available
50% Meteorology:
Poor visibility/IMC (50%* of these cases)
Wind/windshear/gusty wind (50%* of these cases)
Thunderstorms (17%* of these cases)
17% Wildlife/birds/foreign object

Airline
None noted.

Flight Crew Errors
(relating to…)

50% SOP adherence/SOP cross-verification:
Intentional non-compliance (93%* of these cases)
Unintentional non-compliance (17%* of these cases)
42% Manual handling/flight controls
17% Failure to go around after destabilized approach

Undesired Aircraft States

83% Vertical, lateral or speed deviations
25% Unstable approach
17% Continued landing after unstable approach
8% Controlled flight towards terrain
8% Long/floated/bounced/firm/off-center/crabbed landing

Countermeasures

50% Overall crew performance
25% Leadership
17% Contingency management

Additional Classifications

No additional classifications

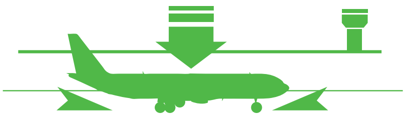
Relationships of Interest, 2010-2014

Meteorologic conditions contributed to **63%** of the accidents on jet aircraft. The rate for turboprops was **25%**.

50% of the accidents involving turboprop aircraft showed signs of deficient training systems. The rate for jet aircraft was **13%**.

Improved leadership was noted as a factor that could have helped prevent **25%** of the accidents.

Note: All accidents had sufficient information for classification.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*



Hard Landing

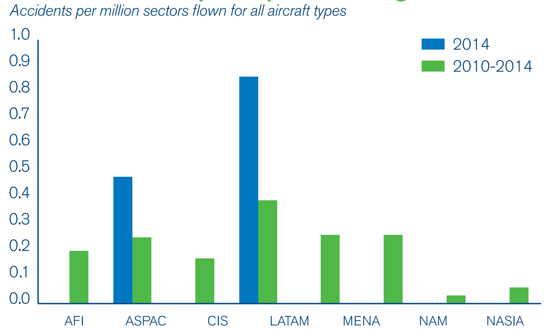
2014	10 Accidents
2010-2014	34 Accidents

	2014	'10-'14
IATA Members	30%	29%
Hull Losses	10%	29%
Fatal	0%	0%
Accident Rate	0.26	0.19

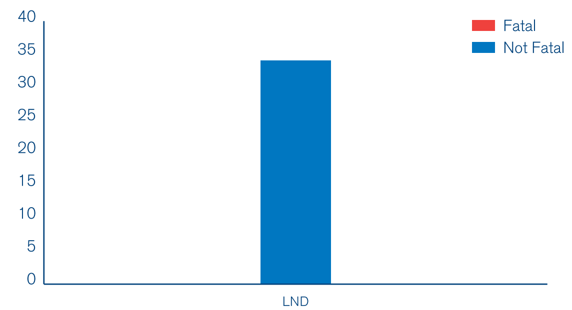
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	90%	10%	33%	70%	30%
2010-2014	88%	9%	3%	65%	35%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

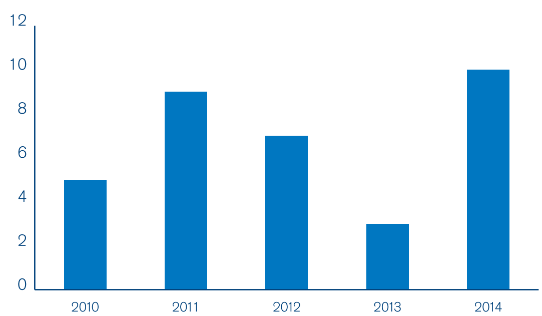


Accidents per Phase of Flight, 2010-2014



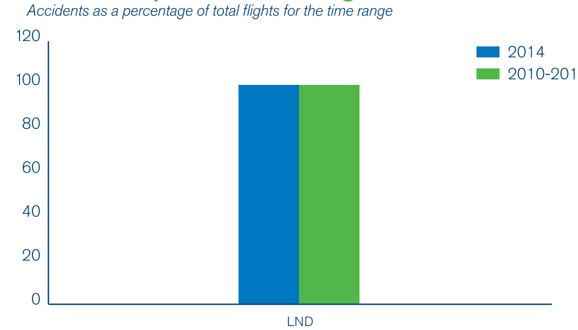
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

30% Flight operations: Training systems
20% Safety management
10% Selection systems
10% Regulatory oversight
7% Dispatch

Threats

Environmental
47% Meteorology:
Wind/wind shear/gusty wind (86%* of these cases)
Poor visibility/IMC (14%* of these cases)
Icing conditions (14%* of these cases)
7% Air traffic services
3% Ground-based navigation aids malfunctioning or not available

Airline
3% Aircraft malfunction:
Gear/Tire (100% of these cases)
3% Operational pressure

Flight Crew Errors (relating to…)

70% Manual handling/flight controls
20% SOP adherence/SOP cross-verification:
Unintentional non-compliance (67% of these cases)
Intentional non-compliance (33% of these cases)
17% Failure to go around after destabilized approach

Undesired Aircraft States

70% Long/floated/bounced/firm/off-center/crabbed landing
23% Unstable approach
23% Vertical, lateral or speed deviations
17% Abrupt aircraft control
17% Continued landing after unstable approach

Countermeasures

30% Overall crew performance
20% Monitor/cross-check
13% Contingency management
7% Plans stated

Additional Classifications

12% Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Windshear and gusty wind conditions were present in **64%** of the turboprop accidents, while the rate for jets was of **26%**.

In **36%** of the hard landings on turboprop aircraft, a failure to go around after an unstable approach was noted as a contributing factor; the rate for jet aircraft was of **5%**.

In the accidents involving a hull loss, **70%** involved deficient manual handling of the aircraft, **60%** involved poor meteorologic conditions, and **40%** involved evidences of weak safety management systems at the airline level.

Note: 4 Hard Landing accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

Gear-up Landing/ Gear Collapse

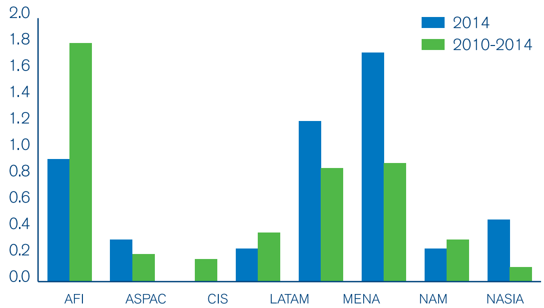
2014	17 Accidents
2010-2014	72 Accidents

	2014	'10-'14
IATA Members	24%	22%
Hull Losses	12%	18%
Fatal	0%	0%
Accident Rate	0.45	0.40

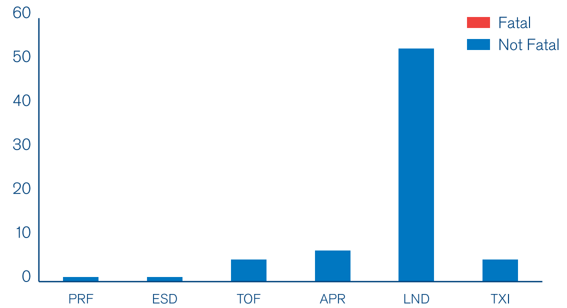
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	71%	29%	0%	41%	59%
2010-2014	74%	22%	4%	42%	58%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

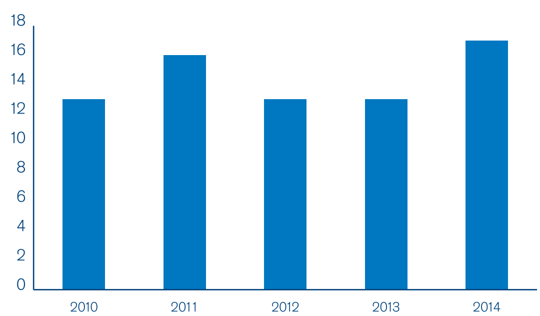


Accidents per Phase of Flight, 2010-2014



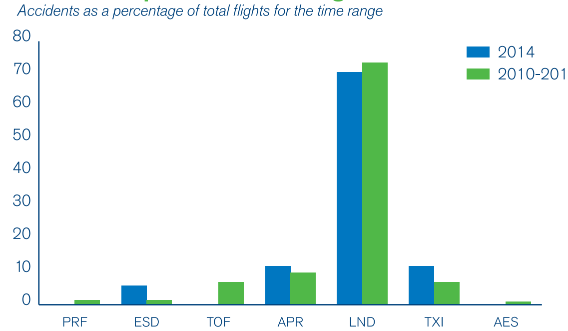
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

- **25%** Maintenance operations: SOPs & checking
- **17%** Design
- **13%** Regulatory oversight
- **11%** Maintenance operations: Training systems
- **9%** Safety management

Threats

Environmental
- **2%** Wildlife/birds/foreign object
- **2%** Meteorology: Wind/wind shear/gusty wind (100% of these cases)
- **2%** Airport facilities

Airline
- **79%** Aircraft malfunction: Gear/tire (95%* of these cases) Hydraulic system failure (7%* of these cases)
- **34%** Maintenance events

Flight Crew Errors (relating to…)

- **8%** Manual handling/flight controls
- **6%** SOP adherence/SOP cross-verification: Intentional non-compliance (33% of these cases) Unknown (33% of these cases)
- **2%** Pilot-to-pilot communication

Undesired Aircraft States

- **9%** Landing gear

Countermeasures

- **2%** Contingency management
- **2%** Monitor/cross-check
- **2%** Overall crew performance

Additional Classifications

- **26%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

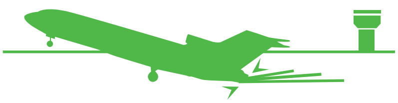
In **92%** of the accidents involving jet aircraft, an aircraft malfuntion was also noted. The rate for turboprops was of **74%**.

Deficiencies in oversight by the regulatory authority were present in **22%** of the turboprop accidents, while the rate on jet accidents was **4%**.

Weak safety management systems contributed to **15%** of the turboprop accidents and to **4%** of the jet accidents.

Note: 19 Gear-Up landing/Gear Collapse accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.

** The sum of the percentages may exceed 100% due to multiple contributing factors.*



Tailstrike

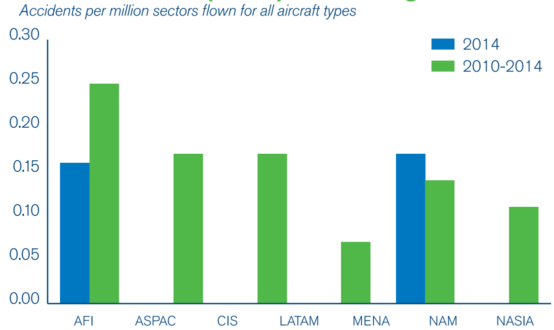
2014 — 3 Accidents
2010-2014 — 26 Accidents

	2014	'10-'14
IATA Members	0%	65%
Hull Losses	0%	4%
Fatal	0%	0%
Accident Rate	0.08	0.15

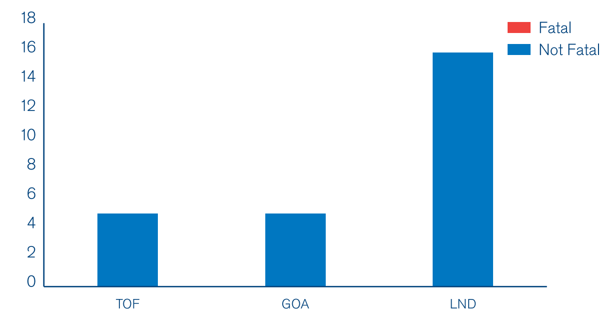
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	100%	0%	0%	100%	0%
2010-2014	85%	15%	0%	85%	15%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

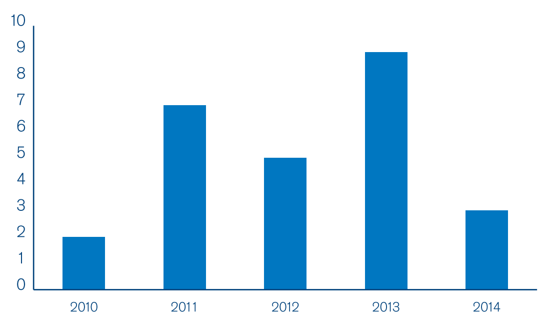


Accidents per Phase of Flight, 2010-2014



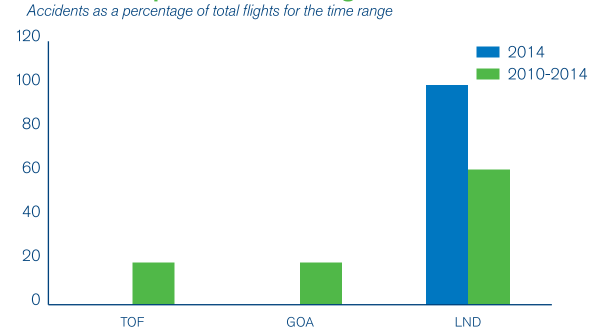
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

- **23%** Flight operations: Training systems
- **18%** Regulatory oversight
- **14%** Technology & equipment
- **9%** Change management
- **5%** Ground operations: SOPs & checking

Threats

Environmental

- **32%** Meteorology:
  - Wind/wind shear/gusty wind (86%* of these cases)
  - Poor visibility /IMC (14%* of these cases)
- **9%** Ground-based navigation aids malfunctioning or not available
- **5%** Wildlife/birds/foreign object

Airline

- **5%** Dispatch/paperwork

Flight Crew Errors (relating to…)

- **64%** Manual handling/flight controls
- **27%** SOP adherence/SOP cross-verification:
  - Unintentional non-compliance (67% of these cases)
  - Intentional non-compliance (33% of these cases)
- **9%** Failure to go around after destabilized approach

Undesired Aircraft States

- **36%** Long/floated/bounced/firm/off-center/crabbed landing
- **27%** Operation outside aircraft limitations
- **14%** Vertical, lateral or speed deviations
- **14%** Weight & balance
- **9%** Continued landing after unstable approach

Countermeasures

- **18%** Monitor/cross-check
- **14%** Captain should show leadership
- **14%** Contingency management

Additional Classifications

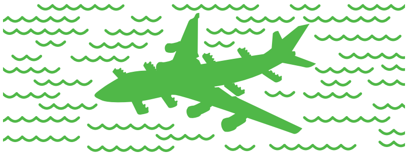
- **15%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

50% of the turboprop accidents also involved a continued landing after an unstable approach, with errors related to the manual handling of the aircraft being present in all turboprop accidents

23% of the jet accidents happened in the presence of gusty wind conditions, while **36%** involved a long, floated or bounced landing. Improved leadership skills could have acted as a countermeasure to the accident.

Note: 4 Tailstrike accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*



Off-Airport Landing/ Ditching

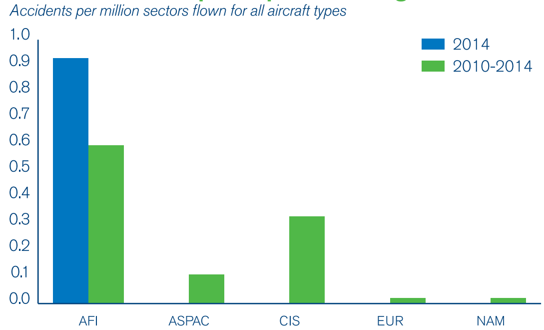
2014 1 Accident
2010-2014 10 Accidents

	2014	'10-'14
IATA Members	0%	10%
Hull Losses	0%	80%
Fatal	0%	40%
Accident Rate	0.03	0.06

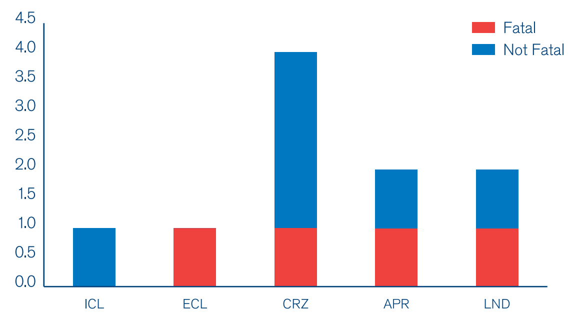
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	0%	0%	100%	100%	0%
2010-2014	50%	40%	10%	30%	70%

Accident Rates per Operator Region

Accidents per million sectors flown for all aircraft types

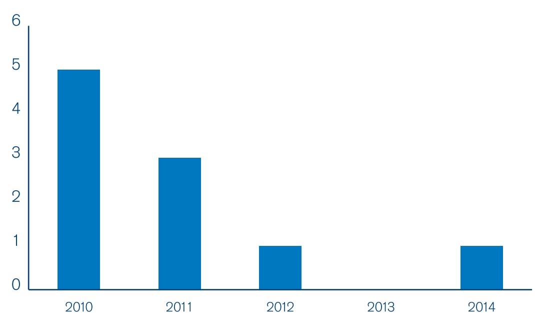


Accidents per Phase of Flight, 2010-2014



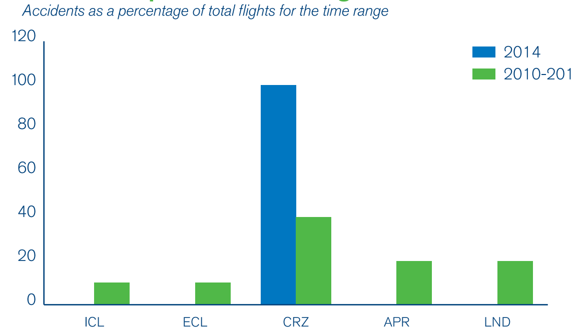
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

38% Regulatory oversight
25% Flight operations: Training systems
12% Flight operations: SOPs & checking
12% Safety management

Threats

Environmental
None noted.

Airline
75% Aircraft malfunction:
Fire/smoke (cockpit/cabin/cargo) (50% of these cases)
Contained engine failure/powerplant malfunction (33% of these cases)
25% Maintenance events
12% Operational pressure

Flight Crew Errors
(relating to…)

25% Manual handling/flight controls
25% SOP adherence/SOP cross-verification:
Intentional non-compliance (100% of these cases)
12% Abnormal checklist

Undesired Aircraft States

12% Engine
12% Landing gear
12% Operation outside aircraft limitations

Countermeasures

25% Overall crew performance
12% Captain should show leadership
12% Communication environment
12% Contingency management

Additional Classifications

20% Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Flight crew errors in the manual handling of the aircraft were noted in all of tailstrikes involving turboprop aircraft. **50%** of the turboprop accidents resulted from a continued landing after an unstable approach.

A long, floated, bounced, firm, off-center or crabbed landing contributed to **44%** of jet accidents. Poor meteorologic conditions also contributed to **33%** of the jet accidents.

Lack of regulatory oversight was evident in **50%** of the turboprop accidents and **11%** of the jet accidents.

Note: 2 Off-Airport Landing/Ditching accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

OVERALL ACCIDENT OVERVIEW

Accidents (2010-2014)

	Total Accidents	IATA Members	Hull Losses	Fatal	Passenger	Cargo	Ferry	Jet	Turboprop	Fatalities
2014	73	17	24	12	54	18	1	39	34	641
2013	81	28	32	16	63	15	3	38	43	210
2012	75	13	32	15	58	14	3	29	46	414
2011	92	34	39	22	79	10	3	55	37	490
2010	94	25	43	23	69	23	2	59	35	786

Accidents per Category (2010-2014)

	Controlled Flight into Terrain	Loss of Control In-flight	Mid-air Collision	Runway/ Taxiway Excursion	In-flight Damage	Ground Damage	Undershoot	Hard Landing	Gear-up Landing/ Gear Collapse	Tailstrike	Off-Airport Landing/ Ditching	Other End State
2014	5	6	-	15	8	5	-	10	17	3	1	3
2013	6	8	-	17	7	12	2	3	13	9	-	2
2012	6	6	1	21	4	8	1	7	13	5	1	2
2011	10	8	-	17	5	15	1	9	16	7	3	-
2010	7	10	-	20	9	10	8	5	13	2	5	2

Jet

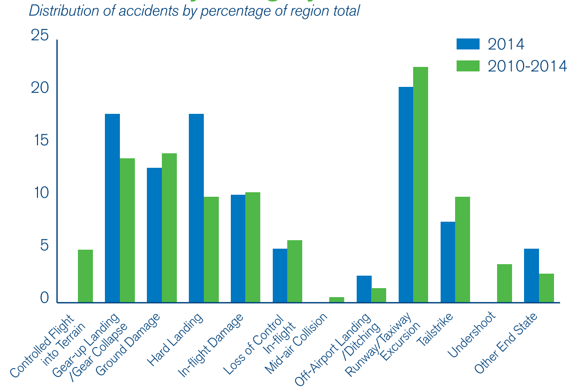
2014	39 Accidents
2010-2014	220 Accidents

	2014	'10-'14
IATA Members	38%	45%
Hull Losses	18%	29%
Fatal	8%	15%
Accident Rate	1.27	1.55

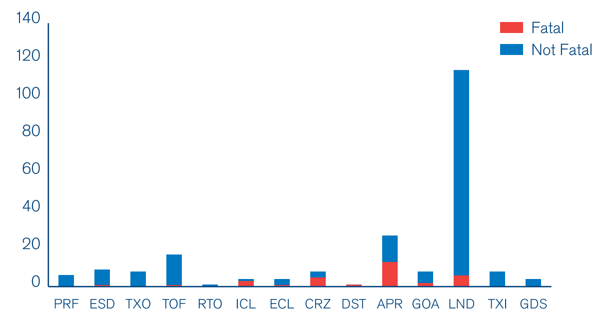
	Passenger	Cargo	Ferry
2014	82%	15%	3%
2010-2014	83%	14%	3%

Breakdown by Category

Distribution of accidents by percentage of region total

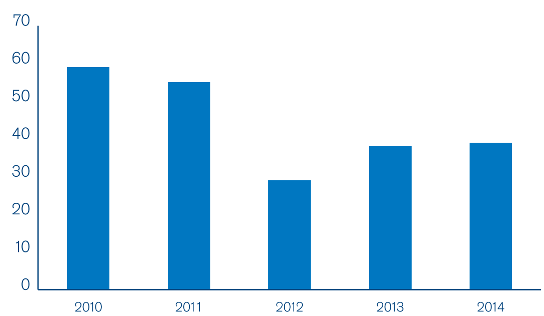


Accidents per Phase of Flight, 2010-2014



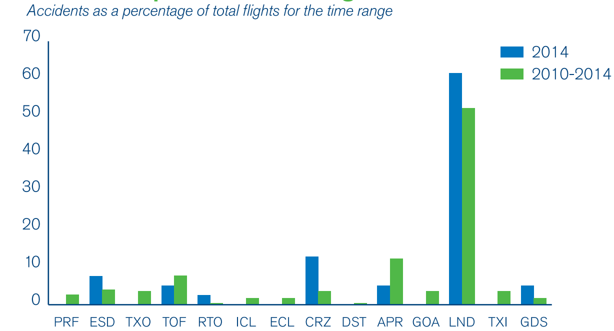
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

23% Regulatory oversight
15% Safety management
15% Flight operations: Training systems
8% Maintenance operations: SOPs & checking
7% Flight operations: SOPs & checking

Threats

Environmental
30% Meteorology:
Wind/windshear/gusty wind (49%* of these cases)

Threats (cont'd)

Poor visibility/IMC (37%* of these cases)
Thunderstorms (25%* of these cases)
15% Airport facilities
13% Ground-based navigation aids malfunctioning or not available

Airline
28% Aircraft malfunction:
Gear/tire (49% of these cases)
Fire/smoke (cockpit/cabin/cargo) (13% of these cases)
13% Maintenance events
4% Ground events

Flight Crew Errors (relating to…)

29% Manual handling/flight controls
25% SOP adherence/SOP cross-verification:
Intentional non-compliance (65% of these cases)
Unintentional non-compliance (35% of these cases)
9% Failure to go around after destabilized approach

Undesired Aircraft States

24% Long/floated/bounced/ firm/off-center/crabbed landing
21% Vertical, lateral or speed deviations
10% Unstable approach
8% Continued landing after unstable approach
7% Operation outside aircraft limitations

Countermeasures

22% Overall crew performance
20% Monitor/cross-check
11% Contingency management
9% Leadership

Additional Classifications

11% Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Non-adherence to SOP or inadequate SOP cross-verification was present in **58%** of the accidents involving CIS-registered aircraft. The rates for other regions were: **32%** in ASPAC, **27%** in EUR, 25% in AFI, **21%** in MENA, **17%** in LATAM, **12%** in NAM and **11%** in NASIA.
Poor meteorologic conditions were identified in **85%** of the jet fatal accidents on approach, with **62%** being related to poor visibility and **85%** involved vertical, lateral or speed deviation.

69% of the fatal accidents on approach also involved inadequate regulatory oversight.
Evidence of weak airline safety management systems were identified in **31%** of these accidents.
Improved monitoring and cross-checking and stronger ability for flight crews to develop an effective strategy to manage the safety threats could have helped prevent **54%** and **23%** of jet fatal accidents, respectively.

Note: 24 jet accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

Turboprop

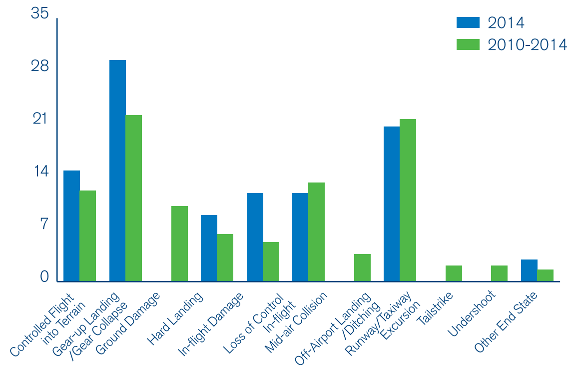
2014 34 Accidents
2010-2014 195 Accidents

	2014	'10-'14
IATA Members	6%	10%
Hull Losses	50%	54%
Fatal	26%	28%
Accident Rate	4.61	5.33

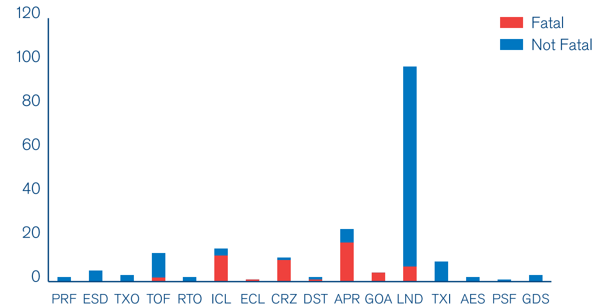
	Passenger	Cargo	Ferry
2014	65%	35%	0%
2010-2014	72%	26%	2%

Breakdown by Category

Distribution of accidents by percentage of region total

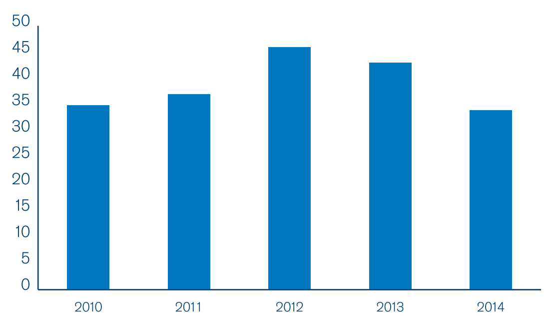


Accidents per Phase of Flight, 2010-2014



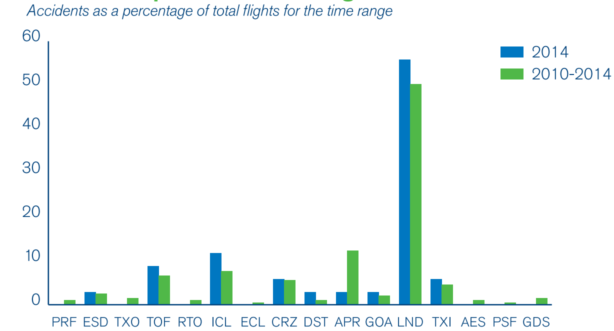
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

- **33%** Regulatory oversight
- **25%** Safety management
- **10%** Flight operations: Training systems
- **9%** Technology & equipment
- **7%** Flight operations: SOPs & checking

Threats
Environmental

- **25%** Meteorology:
  Wind/windshear/gusty wind (53%* of these cases)
  Poor visibility/IMC (44%* of these cases)
  Thunderstorms (17%* of these cases)

Threats
(cont'd)

- **10%** Airport facilities
- **10%** Ground-based navigation aids malfunctioning or not available

Airline

- **29%** Aircraft malfunction:
  Gear/tire (47% of these cases)
  Contained engine failure/ powerplant malfunction (28% of these cases)
- **7%** Maintenance events
- **7%** Ground events

Flight Crew Errors
(relating to…)

- **23%** Manual handling/flight controls
- **19%** SOP adherence/SOP cross-verification:
  Intentional non-compliance (68% of these cases)
  Unintentional non-compliance (32% of these cases)
- **7%** Failure to go around after destabilized approach

Undesired Aircraft States

- **14%** Long/floated/bounced/ firm/off-center/crabbed landing
- **12%** Vertical, lateral or speed deviations
- **9%** Unstable approach
- **7%** Continued landing after unstable approach
- **7%** Loss of aircraft control while on the ground

Countermeasures

- **22%** Overall crew performance
- **10%** Monitor/cross-check
- **8%** Contingency management
- **5%** Leadership

Additional Classifications

- **25%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Non-adherence to SOP or inadequate SOP cross-verification was present in **56%** of the accidents involving CIS-registered aircraft. The rates for other regions were: **50%** in NASIA, **30%** in ASPAC, **20%** in EUR, **18%** in LATAM, **17%** in MENA, **14%** in AFI and **3%** in NAM.

Malfunctioning or non-existing ground-based nav aids were identified in **46%** of the turboprop fatal accidents on approach and **38%** involved vertical, lateral or speed deviation.

62% of the fatal accidents on approach also involved inadequate regulatory oversight. Evidence of weak airline safety management systems were identified in **62%** of these accidents.

Improved monitoring and cross-checking and stronger leadership skills could have helped prevent **31%** and **23%** of turboprop fatal accidents, respectively.

Note: 49 turboprop accidents were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

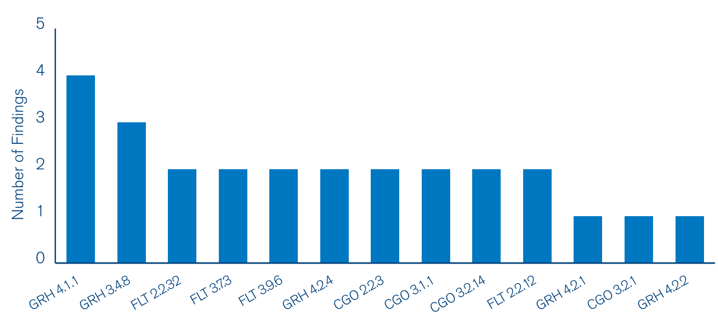
2014 Audit Results

To assist operators in better understanding the latent conditions related to the top three high-risk accident categories, IATA prepared a review of the IOSA Standards and Recommended Practices (ISARPs) related to Loss of Control In-flight, Controlled Flight into Terrain, and Runway Excursions. These ISARPs were selected based on a review of the contributing factors to these categories as well as expert insight. This section presents the top findings and observations associated with the relevant ISARPs. For full details of the ISARPs, please refer to the IOSA Standards Manual.

Standards are requirements of the IOSA program, and any non-conformities which result in findings must be closed to achieve registration. Recommended practices are guidance for operators, and any non-conformities which result in observations do not have to be closed to achieve registration (closure is at the operator's discretion).

LOSS OF CONTROL IN-FLIGHT

Audit Results



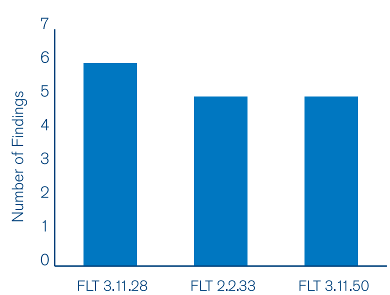
Details of Results

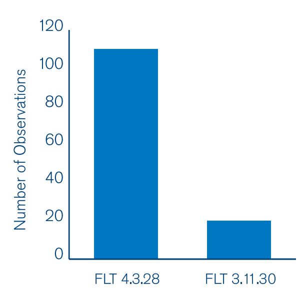
Deficiencies in the operator's policies or procedures led to common findings related to:

- The storage and certification of de-icing/anti-icing fluid and/or fuel
- The handling of aircraft cargo and/or dangerous goods
- Flights in proximity to adverse weather

CONTROLLED FLIGHT INTO TERRAIN

Audit Results





Details of Results

Primary findings related to the operator's requirements to:

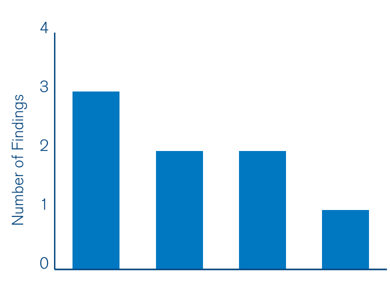
- Restrict descent rates at low height above ground level
- Ensure crews receive regular terrain-closure training

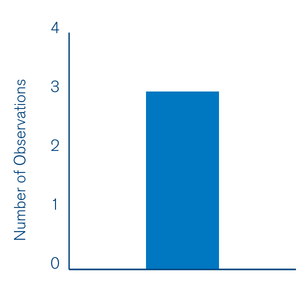
The two leading observations related to:

- The installation of forward-looking wind shear warning systems
- The use of barometric pressure as the sole altitude reference for the takeoff, approach, and landing phases of flight

RUNWAY EXCURSION

Audit Results





Details of Results

Primary findings related to the operator's requirements to define and provide procedures to ensure stable descent profiles and approach criteria.

The most common observation related to operator's guidance for crews to assess that sufficient landing distance is available on the runway of intended use.

“Although CIS had the worst performance (0.83) among the regions (jet hull losses), it scored the best year-to-year improvement for three consecutive years”

Section 5

In-Depth Regional Accident Analysis

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

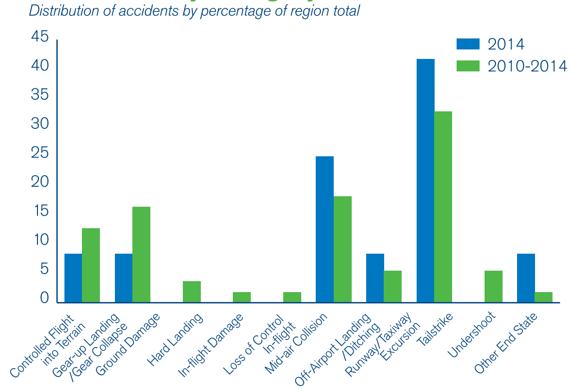
2014	12 Accidents
2010-2014	58 Accidents

	2014	'10-'14
IATA Members	8%	13%
Hull Losses	67%	67%
Fatal	33%	33%
Accident Rate	11.18	11.64

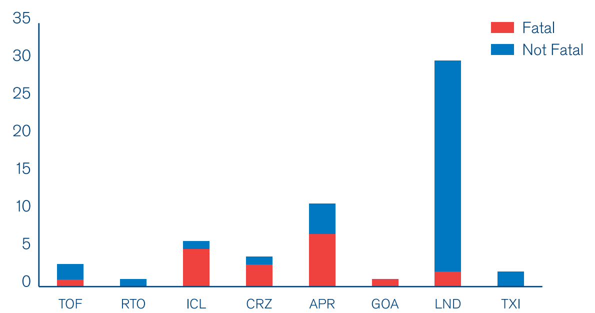
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	42%	50%	8%	17%	83%
2010-2014	56%	34%	10%	33%	70%

Breakdown by Category

Distribution of accidents by percentage of region total

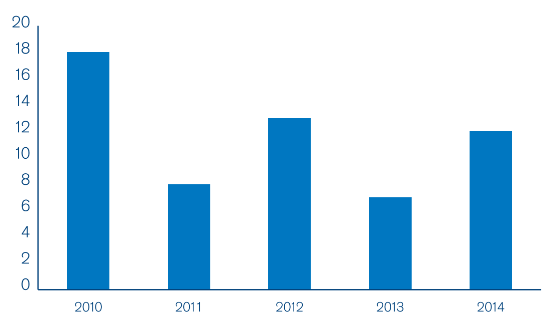


Accidents per Phase of Flight, 2010-2014



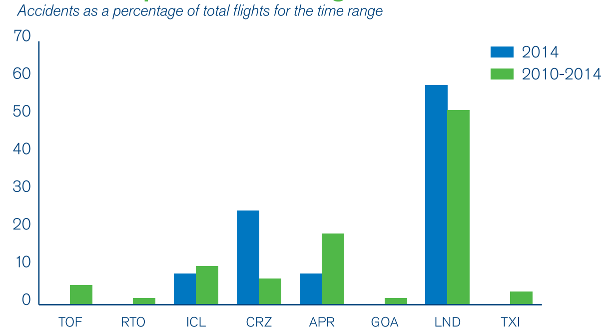
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

- **42%** Regulatory oversight
- **24%** Safety management
- **13%** Flight operations: Training systems
- **13%** Flight operations: SOPs & checking
- **8%** Selection systems

Threats
Environmental

- **24%** Airport Facilities

Threats
(cont'd)

- **21%** Meteorology:
  - Thunderstorms (88%* of these cases)
  - Poor visibility/IMC (50%* of these cases)
  - Wind/windshear/gusty wind (38%* of these cases)
- **13%** Ground-based navigation aids malfunctioning or not available

Airline

- **29%** Aircraft malfunction:
  - Gear/tire (55% of these cases)
  - Contained engine failure (27% of these cases)
- **8%** Maintenance events
- **3%** Manuals/charts/checklists

Flight Crew Errors
(relating to…)

- **18%** Manual handling of flight controls
- **18%** SOP adherence/SOP cross-verification:
  - Intentional non-compliance (86% of these cases)
  - Unintentional non-compliance (14% of these cases)
- **16%** Failure to go around after destabilized approach

Undesired Aircraft States

- **18%** Long/floated/bounced/firm/off-center/crabbed landing
- **16%** Vertical/lateral/speed deviation
- **8%** Continued landing after unstable approach
- **5%** Engine
- **5%** Loss of aircraft control while on the ground

Countermeasures

- **21%** Overall crew performance
- **8%** Contingency management
- **8%** Monitor/cross-check
- **5%** Automation management

Additional Classifications

- **34%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Aircraft malfunction occurred in **18%** of turboprop accidents and in **43%** of jet accidents,, of those **42%** ended in a runway/taxiway excursion. Improved overall crew performance could have helped prevent **24%** of the accidents.

42% of the accidents involved regulatory oversight; **25%** of the errors related to these cases were due to non-adherence to SOP and cross-verification. All fatal accidents occurred during the initial climb or during the approach phases.

Note: 20 accidents involving operators from AFI in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest

** The sum of the percentages may exceed 100% due to multiple contributing factors.*

Asia/Pacific

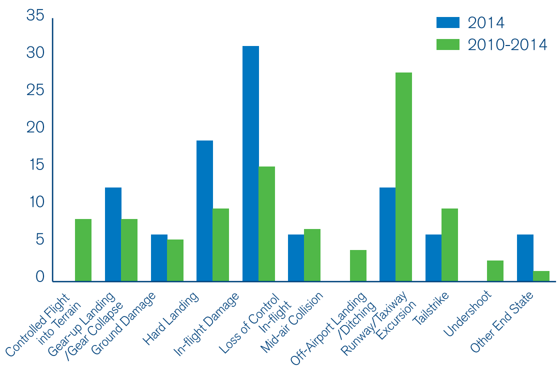
2014	16 Accidents
2010-2014	74 Accidents

	2014	'10-'14
IATA Members	38%	33%
Hull Losses	13%	38%
Fatal	13%	23%
Accident Rate	2.57	2.65

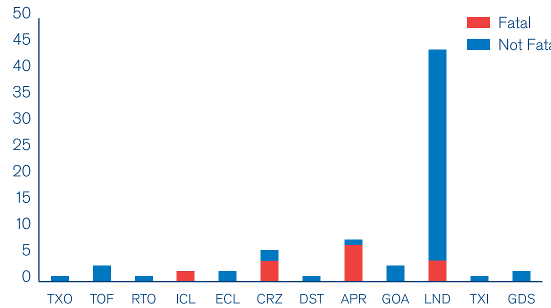
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	94%	6%	0%	81%	19%
2010-2014	88%	12%	0%	58%	42%

Breakdown by Category

Distribution of accidents by percentage of region total

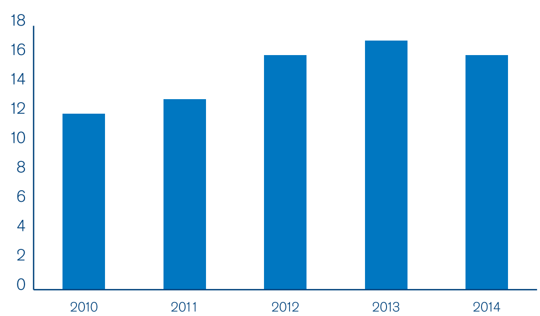


Accidents per Phase of Flight, 2010-2014



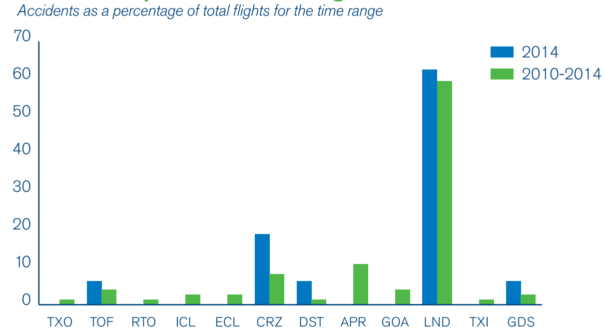
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

Latent Conditions
(deficiencies in…)

- **48%** Regulatory oversight
- **36%** Safety management
- **17%** Flight operations: training systems
- **9%** Flight operations: SOPs & checking
- **8%** Maintenance operations: SOPs & checking

Threats

Environmental

- **28%** Meteorology:
  Wind/wind shear/gusty wind (44%* of cases)
  Poor visibility/IMC (39%* of cases)
  Thunderstorms (33%* of these cases)

Threats
(cont'd)

- **20%** Ground-based navigation aids malfunctioning or not available
- **11%** Airport facilities

Airline

- **25%** Aircraft malfunction:
  Gear/tire (31% of cases)
  Fire/smoke (cockpit/cabin/cargo) (19% of cases)
- **9%** Maintenance events
- **3%** Operational pressure

Flight Crew Errors
(relating to…)

- **39%** Manual handling/flight controls
- **31%** SOP adherence/SOP cross-verification:
  Intentional non-compliance (75% of these cases)
  Unintentional non-compliance (15% of these cases)
- **11%** Pilot-to-pilot communication

Undesired Aircraft States

- **30%** Long/floated/bounced/firm/off-center/crabbed landing
- **22%** Vertical/lateral/speed deviation
- **14%** Continued landing after unstable approach
- **11%** Operation outside aircraft limitations
- **11%** Unstable approach

Countermeasures

- **34%** Overall crew performance
- **27%** Monitor/cross-check
- **14%** Contingency management
- **11%** Captain should show leadership

Additional Classifications

- **14%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

52% of the turboprop accidents involved evidence of weak safety management systems. The rate for jets was of **27%**. **60%** of the turboprop accidents indicated weak regulatory oversight as a contributing factor, compared to **41%** for the jet category.

39% of the accidents indicate inadequate manual handling of the aircraft, **36%** of those accidents are associated with weak training systems as a latent condition.

On **48%** of them, improved overall crew performance could have helped prevent the accident.

17 Accidents were fatal, **41%** of them in the approach phase. In **83%** of these accidents, improved monitoring and cross-checking could have helped prevent the accident.

Note: 10 accidents involving operators from ASPAC in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest

** The sum of the percentages may exceed 100% due to multiple contributing factors.*

Commonwealth of Independent States (CIS)

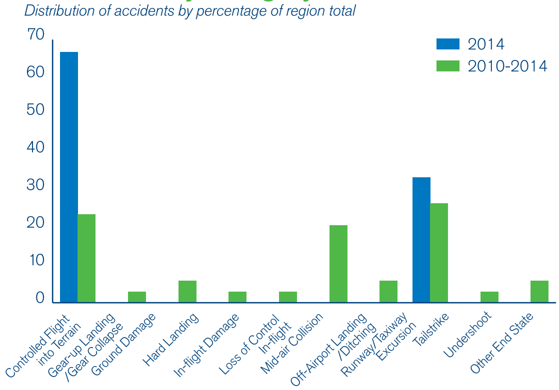
2014 3 Accidents
2010-2014 34 Accidents

	2014	'10-'14
IATA Members	0%	12%
Hull Losses	100%	74%
Fatal	67%	52%
Accident Rate	2.19	5.68

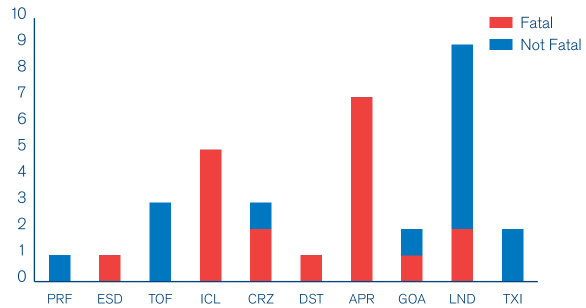
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	33%	67%	0%	33%	67%
2010-2014	74%	20%	6%	65%	35%

Breakdown by Category

Distribution of accidents by percentage of region total

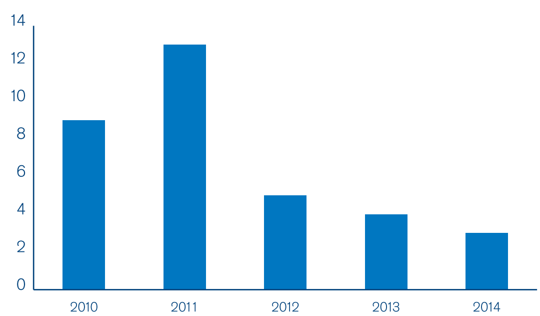


Accidents per Phase of Flight, 2010-2014



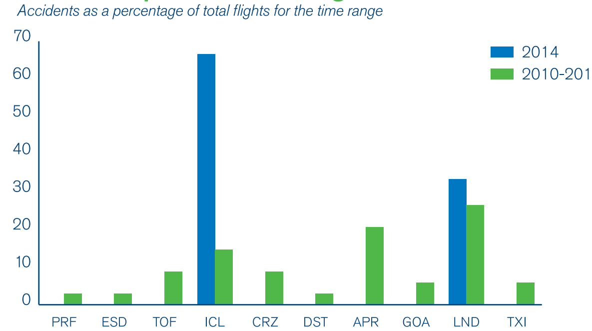
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

- **54%** Regulatory oversight
- **43%** Safety management
- **21%** Flight operations: training systems
- **14%** Technology and equipment
- **11%** Selection systems

Threats

Environmental

- **50%** Meteorology:
  Poor visibility/IMC (64%* of these cases)

Threats
(cont'd)

Wind/wind shear/gusty wind (29%* of these cases)
Icing conditions (21%* of these cases)

- **14%** Air traffic services
- **11%** Airport facilities

Airline

- **29%** Aircraft malfunction:
  Fire/smoke (cockpit/cabin/cargo) (38% of cases)
  Contained engine failure/powerplant malfunction (38% of cases)
- **14%** Maintenance events
- **4%** Operational pressure

Flight Crew Errors
(relating to…)

- **50%** SOP adherence/SOP cross-verification:
  Intentional non-compliance (86%* of these cases)
  Unintentional non-compliance (21%* of these cases)
- **32%** Manual handling/flight controls
- **18%** Callouts

Undesired Aircraft States

- **46%** Vertical/lateral/speed deviation
- **18%** Unnecessary weather penetration
- **18%** Unstable approach
- **11%** Long/floated/bounced/ firm/off-centerline landing
- **11%** Operation outside of aircraft limitations

Countermeasures

- **29%** Overall crew performance
- **18%** Monitor/cross-check
- **14%** Contingency management
- **11%** Captain should show leadership

Additional Classifications

- **18%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

58% of the jet accidents involved a vertical, lateral or speed deviation, significantly higher than the **22%** for turboprop aircraft. Improved monitoring and cross-checking could have helped prevent **26%** of the jet accidents.

54% of the cases noted regulatory oversight as the most relevant latent condition. **67%** of these cases were related to non-adherence to SOP and cross-verification.

Overall crew performance also affected **40%** of weak regulatory oversight cases.

Of the flight phases involving at least one fatal accident, initial climb (**26%**) and approach (**37%**) were the most significant. In **50%** of all cases, meteorology was noted as a contributing factor.

Note: 6 accidents involving operators from CIS in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

Europe

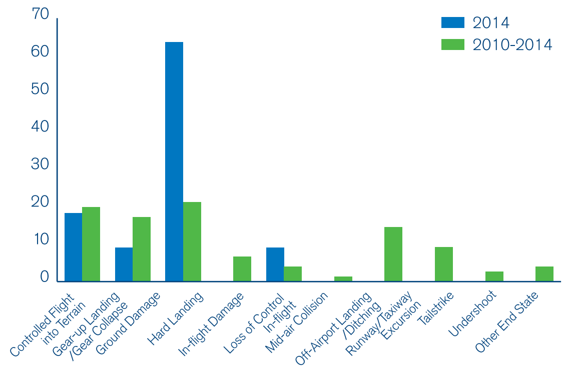
2014	11 Accidents
2010-2014	76 Accidents

	2014	'10-'14
IATA Members	18%	41%
Hull Losses	18%	23%
Fatal	9%	3%
Accident Rate	1.35	1.88

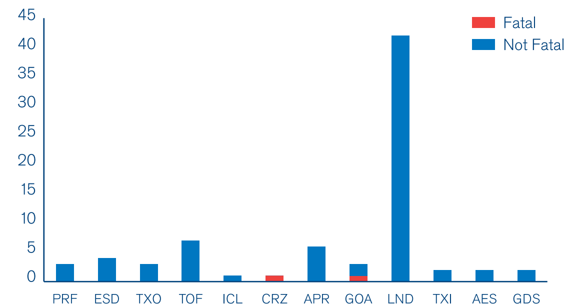
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	82%	18%	0%	73%	27%
2010-2014	80%	17%	3%	56%	44%

Breakdown by Category

Distribution of accidents by percentage of region total

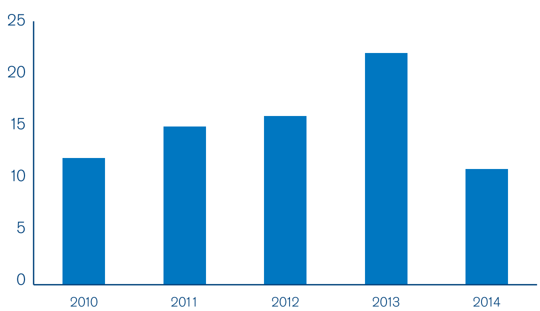


Accidents per Phase of Flight, 2010-2014



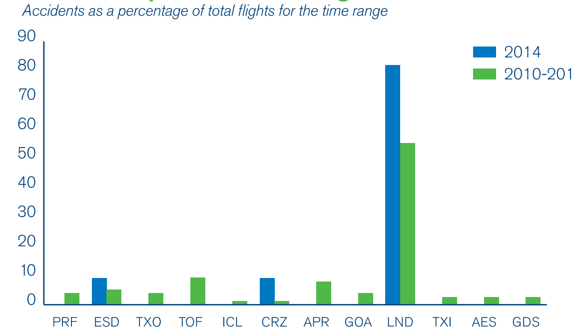
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

- **11%** Flight operations: training systems
- **10%** Regulatory oversight
- **8%** Design
- **8%** Safety management
- **6%** Maintenance operations: SOPs & checking

Threats

Environmental

- **30%** Meteorology:
  Wind/wind shear/gusty wind (76%* of these cases)
  Poor visibility/IMC (14%* of these cases)
  Thunderstorms (10%* of these cases)

Threats
(cont'd)

- **11%** Airport facilities
- **10%** Air traffic services

Airline

- **21%** Aircraft malfunction:
  Gear/tire (67% of cases)
  Fire/smoke (cockpit/cabin/cargo) (13% of cases)
- **10%** Ground events
- **7%** Maintenance events

Flight Crew Errors
(relating to…)

- **28%** Manual handling/flight controls
- **24%** SOP adherence/SOP cross-verification:
  Unintentional non-compliance (53% of these cases)
  Intentional non-compliance (47% of these cases)
- **11%** Failure to go around after destabilization on approach

Undesired Aircraft States

- **24%** Long/floated/bounced/ firm/off-centerline landing
- **11%** Operation outside of aircraft limitations
- **10%** Unstable approach
- **10%** Vertical/lateral/speed deviation
- **8%** Loss of aircraft control while on the ground

Countermeasures

- **17%** Overall crew performance
- **13%** Contingency management
- **10%** Monitor/cross-check
- **7%** Leadership

Additional Classifications

- **7%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

In **33%** of the turboprop accidents, poor meteorologic conditions were present, compared to **21%** for the jet category. Unintentional non-adherence to SOP and cross-verification was noted in **21%** of the jet accidents and in **0%** of the turboprop accidents, whereas intentional non-adherence to SOP and cross-verification was noted in **20%** of the turboprop accidents and **4%** of the jet accidents.

Meteorology was a contributing factor in 30% of accidents in EUR; **62%** of these accidents occurred during the landing phase.

Only 2 accidents were fatal, one of them occurred during the cruise phase and the other during the go-around phase.

Note: 5 accidents involving operators from EUR in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.

** The sum of the percentages may exceed 100% due to multiple contributing factors.*

Latin America & the Caribbean

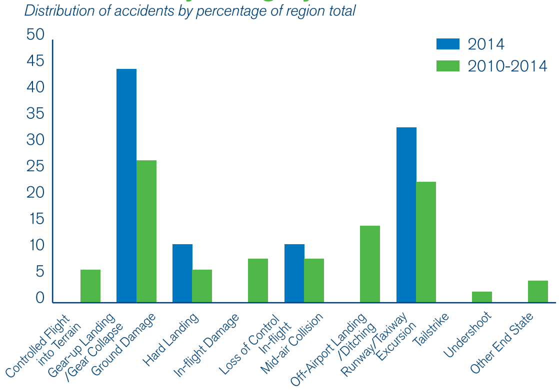
2014 — 9 Accidents
2010-2014 — 48 Accidents

	2014	'10-'14
IATA Members	22%	17%
Hull Losses	22%	56%
Fatal	0%	25%
Accident Rate	2.73	3.16

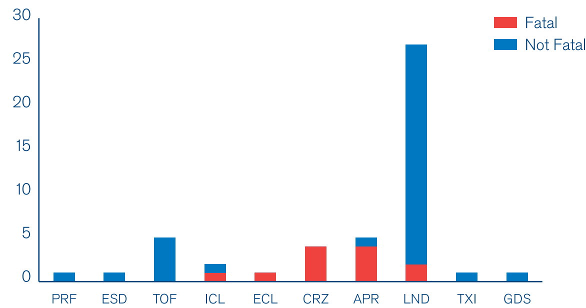
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	78%	22%	0%	44%	56%
2010-2014	88%	12%	0%	44%	56%

Breakdown by Category

Distribution of accidents by percentage of region total

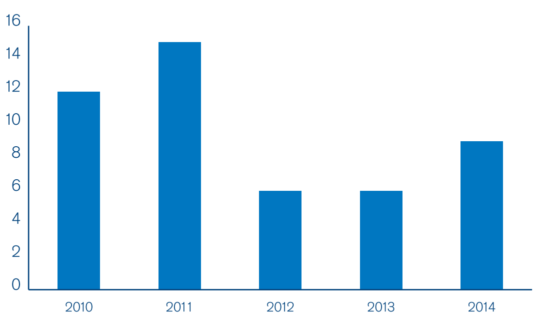


Accidents per Phase of Flight, 2010-2014



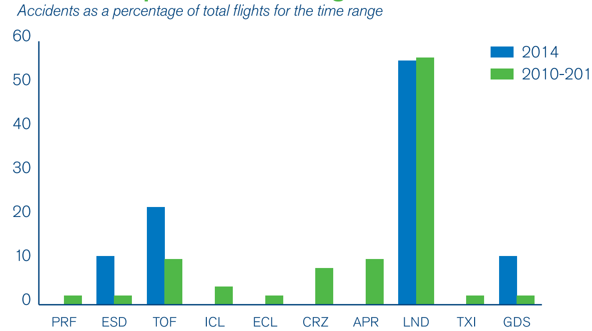
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

22% Safety management
20% Regulatory oversight
12% Maintenance operations: SOPs and checking
12% Flight operations: Training systems
12% Flight operations: SOPs and checking

Threats

Environmental
22% Ground-based nav aid malfunction or not available
20% Meteorology:
Wind/wind shear/gusty wind (38%* of these cases)
Icing conditions (25%* of these cases)
Thunderstorms (25%* of these cases)
12% Airport facilities

Airline
40% Aircraft malfunction:
Gear/tire (56% of cases)
Brakes (12% of cases)
18% Maintenance events
2% Manuals/charts/checklists

Flight Crew Errors (relating to…)

20% Manual handling/flight controls
18% SOP adherence/SOP cross-verification:
Intentional non-compliance (43% of these cases)
Unintentional non-compliance (43% of these cases)
5% Failure to go around after destabilization on approach

Undesired Aircraft States

18% Long/floated/bounced/firm/off-centerline landing
18% Vertical/lateral/speed deviation
12% Unstable approach
10% Continued landing after unstable approach
5% Landing gear

Countermeasures

25% Overall crew performance
18% Monitor/cross-check
12% Leadership

Additional Classifications

17% Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Half of the turboprop accidents were associated with an aircraft malfunction, compared to **28%** on jets.

Weak safety management systems were evident in **23%** of the accidents. Of those, **56%** indicated errors in the manual handling of the aircraft. Improved overall crew performance could have helped prevent **67%** of the accidents.

Flight operations (**44%**) and regulatory oversight (**33%**) represent the most relevant latent conditions in the fatal accidents. Meteorology was a contributing factor in **40%** of those accidents.

Note: 8 accidents involving operators from LATAM in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

Middle East & North Africa

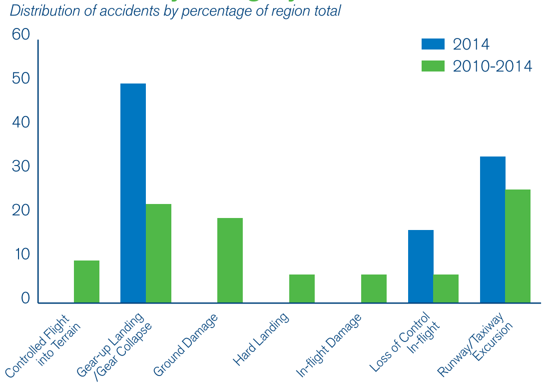
2014	6 Accidents
2010-2014	32 Accidents

	2014	'10-'14
IATA Members	33%	59%
Hull Losses	33%	41%
Fatal	17%	19%
Accident Rate	3.47	4.11

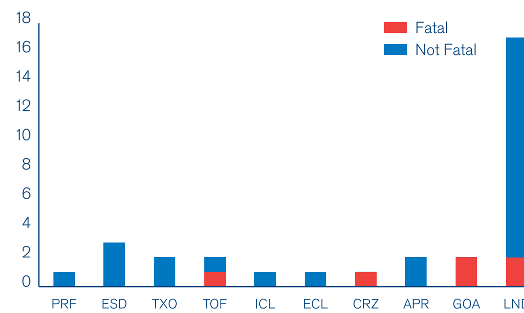
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	100%	0%	0%	67%	33%
2010-2014	97%	0%	3%	75%	25%

Breakdown by Category

Distribution of accidents by percentage of region total

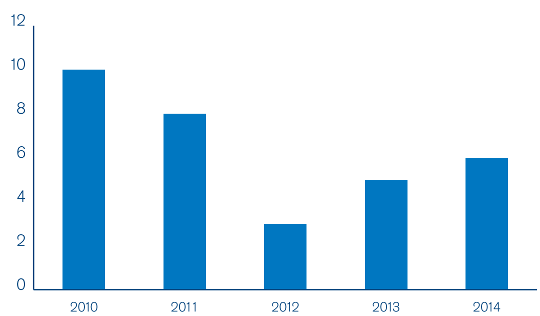


Accidents per Phase of Flight, 2010-2014



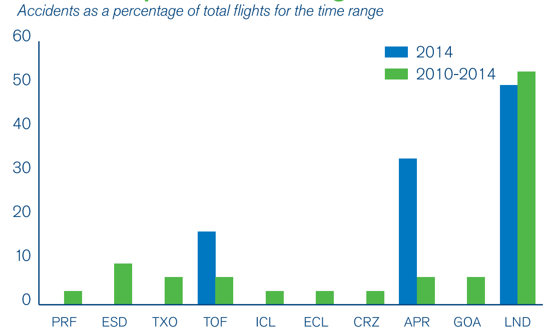
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

- **20%** Regulatory oversight
- **20%** Safety management
- **12%** Flight operations: training systems
- **8%** Design
- **4%** Dispatch

Threats

Environmental

- **36%** Meteorology:
  - Poor visibility/IMC (56% of these cases)
  - Wind/wind shear/gusty wind (22% of these cases)
  - Thunderstorms (11% of these cases)

Threats
(cont'd)

- **16%** Airport facilities
- **12%** Air traffic services

Airline

- **36%** Aircraft malfunction:
  - Gear/tire (44% of cases)
  - Contained engine failure/ powerplant malfunction (33% of cases)
- **16%** Maintenance events
- **4%** Ground events

Flight Crew Errors
(relating to…)

- **28%** Manual handling/flight controls
- **20%** SOP adherence/SOP cross-verification:
  - Intentional non-compliance (60% of these cases)
  - Unintentional non-compliance (40% of these cases)
- **8%** Callouts

Undesired Aircraft States

- **16%** Long/floated/ bounced/firm/off-centerline landing
- **16%** Vertical/lateral/speed deviation
- **12%** Continued landing after unstable approach
- **12%** Unnecessary weather penetration
- **12%** Unstable approach

Countermeasures

- **20%** Overall crew performance
- **16%** Monitor/cross-check
- **8%** FO is assertive when necessary
- **8%** Leadership

Additional Classifications

- **22%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Regulatory oversight is a significantly higher latent condition in the turboprop (**50%**) accidents than in the jet (**10%**) accidents. **17%** of the turboprop accidents involved errors in the manual handling of the aircraft. Improved overall crew performance could have helped prevent **33%** of the turboprop accidents.

36% of the accidents were associated to an aircraft malfunction. The same percentage was found when considering poor meteorologic conditions.

6 accidents involved fatalities, with most occurring in the go-around (**33%**) and landing (**33%**) phases. The end states associated with those accidents were loss of control in-flight (**33%**) and controlled flight into terrain (**67%**).

Note: 7 accidents involving operators from MENA in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

North America

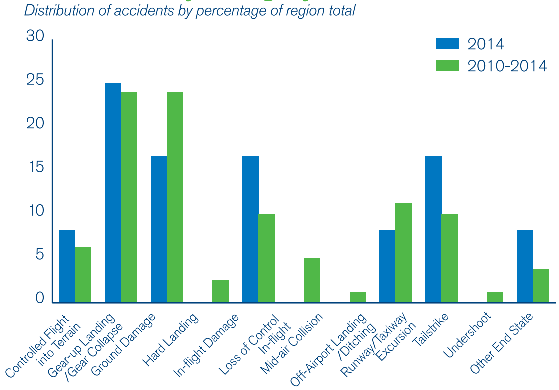
2013	12 Accidents
2010-2014	79 Accidents

	2014	'10-'14
IATA Members	17%	19%
Hull Losses	33%	25%
Fatal	8%	14%
Accident Rate	1.00	1.34

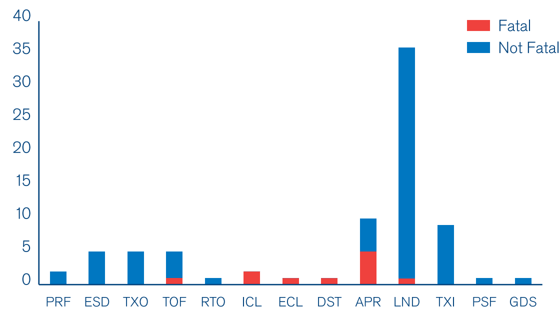
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	67%	33%	0%	42%	58%
2010-2014	71%	28%	1%	49%	51%

Breakdown by Category

Distribution of accidents by percentage of region total

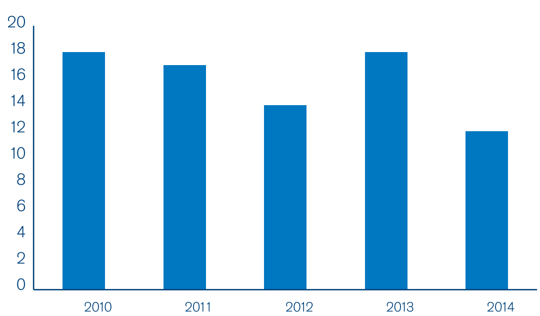


Accidents per Phase of Flight, 2010-2014



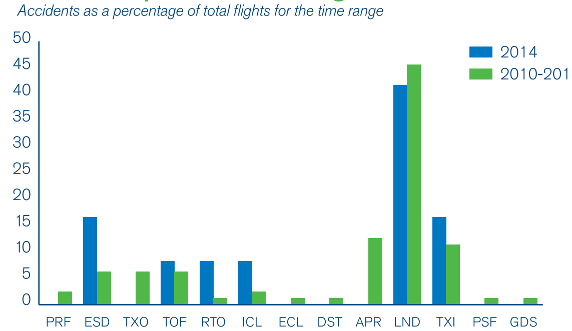
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

- **11%** Regulatory oversight
- **9%** Technology and equipment
- **8%** Maintenance operations: SOPs & checking
- **8%** Design
- **6%** Flight operations: training systems

Threats
Environmental

- **18%** Meteorology:
  Wind/wind shear/gusty wind (75%* of these cases)
  Poor visibility/IMC (50%* of these cases)

Threats
(cont'd)

- **11%** Lack of visual reference
- **9%** Air traffic services

Airline

- **31%** Aircraft malfunction:
  Gear/tire (60% of cases)
  Fire/smoke (cockpit/cabin/cargo) (15% of cases)
- **11%** Ground events
- **8%** Maintenance events

Flight Crew Errors
(relating to…)

- **14%** Manual handling/flight controls
- **8%** SOP adherence/SOP cross-verification:
  Intentional non-compliance (60% of these cases)
  Unintentional non-compliance (40% of these cases)
- **3%** Callouts

Undesired Aircraft States

- **12%** Long/floated/bounced/firm/off-centerline landing
- **9%** Vertical/lateral/speed deviation
- **6%** Controlled flight toward terrain
- **6%** Ramp movements
- **5%** Loss of aircraft control while on the ground

Countermeasures

- **9%** Monitor/cross-check
- **9%** Overall crew performance
- **3%** Contingency management
- **3%** Taxiway/runway management

Additional Classifications

- **18%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

43% of turboprop accidents were a gear-up landing or gear collapse. Only **15%** of the jet accidents had the same end state and, in **21%** of those accidents, inadequate maintenance operation procedures were noted as latent conditions.

18% of the accidents involved poor meteorologic conditions; **33%** of those were declared a hull loss.

45% of the accidents involving fatalities occurred during the approach phase; **75%** of those accidents involved outdated or not installed equipment; **25%** presented omitted callouts. Improved monitoring and cross-checking could have helped prevent **50%** of the accidents

Note: 7 accidents involving operators from NAM in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.

** The sum of the percentages may exceed 100% due to multiple contributing factors.*

North Asia

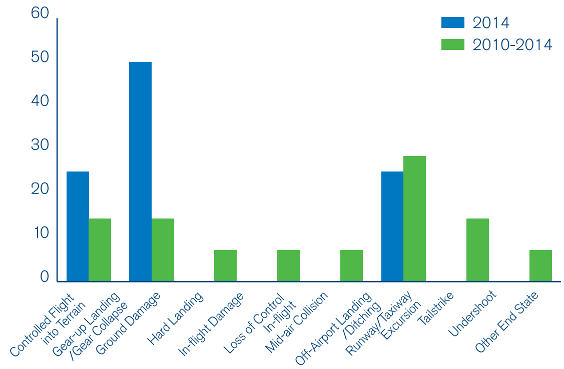
2013	4 Accidents
2010-2014	14 Accidents

	2014	'10-'14
IATA Members	50%	64%
Hull Losses	25%	21%
Fatal	25%	14%
Accident Rate	0.95	0.80

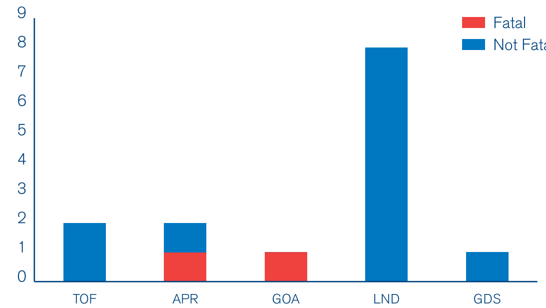
	Passenger	Cargo	Ferry	Jet	Turboprop
2014	75%	25%	0%	50%	50%
2010-2014	71%	29%	0%	79%	21%

Breakdown by Category

Distribution of accidents by percentage of region total

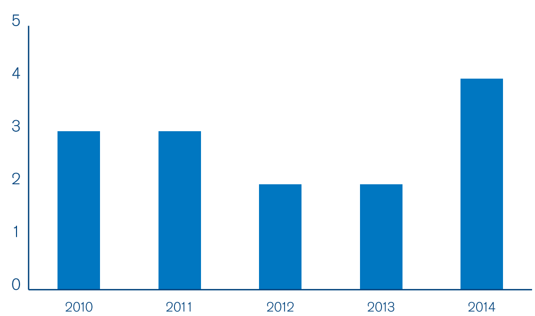


Accidents per Phase of Flight, 2010-2014



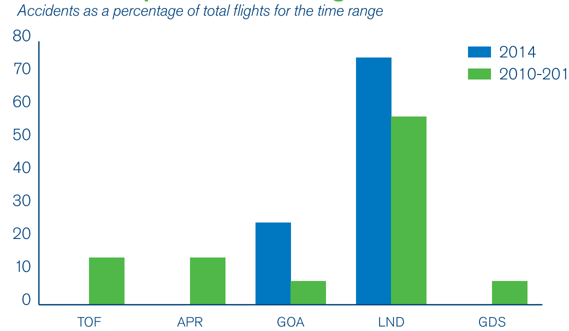
See Annex 1 for "Phase of Flight" definitions

Accidents per Year



Accidents per Phase of Flight

Accidents as a percentage of total flights for the time range



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions
(deficiencies in…)

36% Regulatory oversight
27% Flight operations: training systems
27% Safety management
18% Flight operations: SOPs & checking
9% Ground operations: SOPs & checking

Threats
Environmental
45% Meteorology:
Wind/wind shear/gusty wind (60%* of these cases)
Poor visibility/IMC (40%* of these cases)
Thunderstorms (40%* of these cases)

Threats
(cont'd)

18% Ground-based nav aid malfunction or not available
18% Airport facilities

Airline
27% Aircraft malfunction:
Contained engine failure/ powerplant malfunction (33% of cases)
Flight controls (33% of cases)
9% Dispatch/paperwork
9% Maintenance events

Flight Crew Errors
(relating to…)

45% Manual handling/flight controls
18% SOP adherence/SOP cross-verification:
Intentional non-compliance (50% of these cases)
Unintentional non-compliance (50% of these cases)
9% Briefings

Undesired Aircraft States

36% Long/floated/ bounced/firm/off-centerline landing
18% Controlled flight towards terrain
18% Operation outside aircraft limitations
18% Unstable approach
9% Abrupt aircraft control

Countermeasures

36% Monitor/cross-check
36% Overall crew performance
18% Contingency Management
9% First Officer is assertive when necessary

Additional Classifications

21% Insufficient data for contributing factors

Relationships of Interest, 2010-2014

All turboprop accidents occurred in poor meteorologic conditions, compared to **10%** in jets. Of all the turboprop accidents, **50%** indicated errors in the manual handling of the aircraft, and in **50%** the first officer should have been more assertive.

36% of the accidents involved a long, floated, bounced, firm, off-center or crabbed landing. Of all those, **50%** involved operation outside aircraft limitations. In **50%** of the accidents, improved overall crew performance could have helped prevent the accident.

Only 2 accidents involved fatalities, one occurred during the approach phase and the other one occurred during the go-around phase.

Note: 3 accidents involving operators from NASIA in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

ACCIDENT OVERVIEW

Accidents per IATA Region (2010-2014)

	Africa	Asia/Pacific	Commonwealth of Independent States (CIS)	Europe	Latin America & the Caribbean	Middle East & North Africa	North America	North Asia
2014	12	16	3	11	9	6	12	4
2013	7	17	4	22	6	5	18	2
2012	13	16	5	16	6	3	14	2
2011	8	13	13	15	15	8	17	3
2010	18	12	9	12	12	10	18	3

Image courtesy of Boeing

Section 6

Analysis of Cargo Aircraft Accidents

2014 CARGO OPERATOR OVERVIEW

Cargo vs. Passenger Operations for Jet Aircraft

	Fleet Size End of 2014	2014 HL	HL per 1000 Aircraft	2014 SD	Total	Operational Accidents per 1000 Aircraft
Cargo	2,112	1	0.47	5	6	2.84
Passenger	21,606	6	0.28	26	32	1.48
Total	23,718	7	0.30	31	38	1.60

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 End of 2014	2014 HL	HL per 1000 Aircraft	2014 SD	Total	Operational Accidents per 1000 Aircraft
Cargo	1,362	9	6.61	3	12	8.81
Passenger	3,888	8	2.06	14	22	5.66
Total	5,250	17	3.24	17	34	6.48

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.

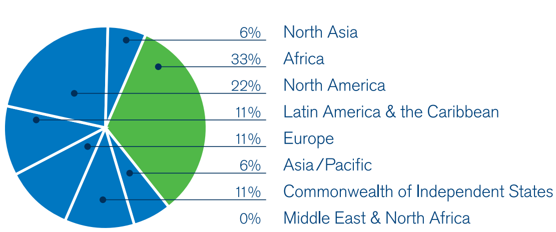
2014 Cargo Aircraft Accidents

18 Accidents

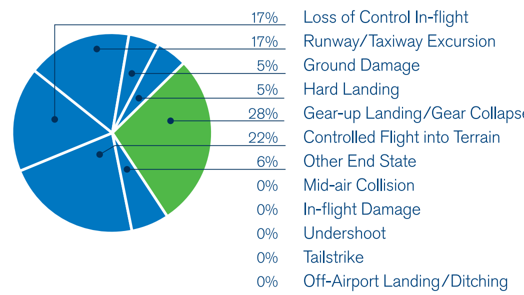
IATA Members	**11%**
Hull Losses	**56%**
Fatal	**39%**

33.% Jet	**67%** Turboprop

Breakdown per Operator Region

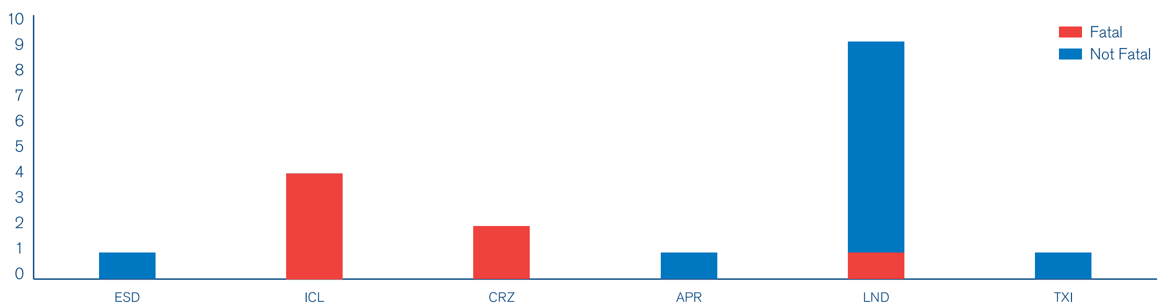


Breakdown per Accident Category



Accidents per Phase of Flight

See Annex 1 for detailed "Phase of Flight" definitions



Top Contributing Factors, 2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

20% Regulatory oversight
20% Maintenance operations: SOPs & checking
10% Maintenance operations: Training systems
10% Management decisions
10% Safety management

Threats

Environmental
20% Lack of visual reference
10% Meteorology:
Poor visibility/IMC (100%* of these cases)
Wind/wind shear/gusty wind (100%* of these cases)

Airline
50% Aircraft malfunction:
Gear/tire (100% of these cases)
20% Maintenance events

Flight Crew Errors (relating to…)

30% Manual handling/flight controls
20% Failure to go around after destabilization on approach
10% SOP adherence/SOP cross-verification
Unknown non-compliance (100% of these cases)

Undesired Aircraft States

50% Long/floated/bounced/firm/off-center/crabbed landing
10% Controlled flight towards terrain
10% Vertical/lateral/speed deviation

Countermeasures

30% Overall crew performance
10% Monitor/Cross-check

Additional Classifications

44% Insufficient data for contributing factors

Relationships of Interest, 2014

60% of jet accidents involved an aircraft malfunction, compared to **40%** in turboprops. Jet (**40%**) accidents indicated twice the amount of errors in the general manual handling of the aircraft than turboprops (**20%**). Both in jet (**20%**) and in turboprop (**40%**) accidents, improved overall crew performance was noted as a countermeasure to the accident.

50% of the accidents that occurred in Africa indicated signs of poor regulatory oversight. Half of the accidents involved a failure to go around after an unstable approach.

57% of the fatal accidents occurred during the initial climb phase; **50%** of them involved non-adherence to SOP. Improved monitoring and cross-checking could have acted as a countermeasure to these accidents.

Note: 8 cargo accidents in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.
** The sum of the percentages may exceed 100% due to multiple contributing factors.*

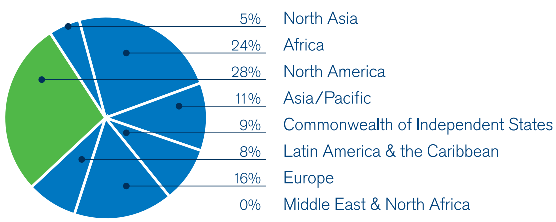
2010-2014 Cargo Aircraft Accidents

80 Accidents

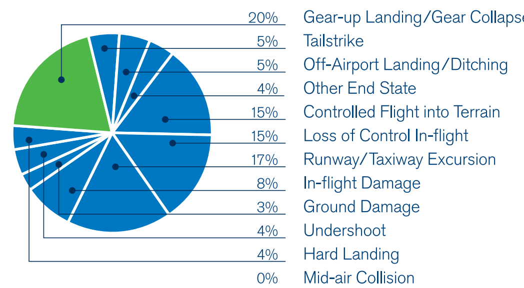
IATA Members	**19%**
Hull Losses	**63%**
Fatal	**35%**

38% Jet | **62%** Turboprop

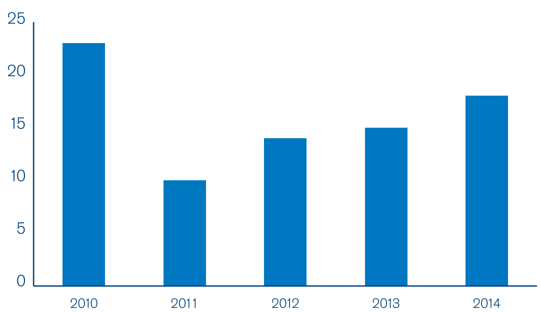
Breakdown per Operator Region



Breakdown per Accident Category

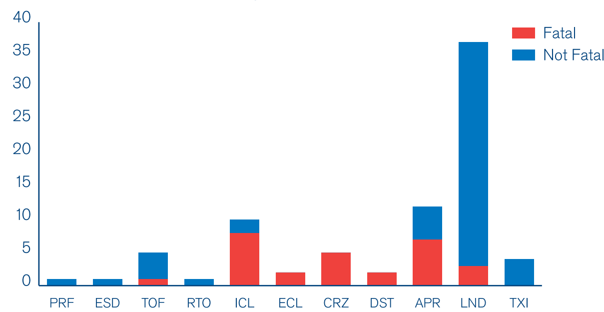


Accidents per Year



Accidents per Phase of Flight

See Annex 1 for detailed "Phase of Flight" definitions



Top Contributing Factors, 2010-2014

See Annex 2 for "Contributing Factors" definitions

Latent Conditions (deficiencies in…)

- **29%** Regulatory oversight
- **20%** Safety management
- **18%** Maintenance operations: SOPs & checking
- **12%** Technology & equipment
- **8%** Maintenance operations: Training systems

Threats

Environmental

- **16%** Meteorology:
  - Poor visibility/IMC (50%* of these cases)
  - Wind/wind shear/gusty wind (50%* of these cases)
  - Thunderstorms (25%* of these cases)
- **12%** Ground-based nav aid malfunction or unavailable
- **8%** Airport facilities

Airline

- **47%** Aircraft malfunction:
  - Gear/tire (42% of these cases)
  - Fire/smoke (cockpit/cabin/cargo) (21% of these cases)
- **16%** Maintenance events
- **4%** Dispatch/paperwork

Flight Crew Errors (relating to…)

- **14%** Manual handling/flight controls
- **6%** Failure to go around after destabilization on approach
- **6%** SOP adherence/SOP cross-verification
  - Intentional non-compliance (67% of these cases)
  - Unintentional non-compliance (33% of these cases)

Undesired Aircraft States

- **16%** Long/floated/bounced/firm/off-center/crabbed landing
- **12%** Vertical/lateral/speed deviation
- **6%** Controlled flight towards terrain
- **4%** Loss of aircraft control while on the ground
- **4%** Unstable approach

Countermeasures

- **12%** Overall crew performance
- **6%** Monitor/Cross-check
- **4%** Contingency management
- **2%** Automation management

Additional Classifications

- **36%** Insufficient data for contributing factors

Relationships of Interest, 2010-2014

Meteorology was a threat affecting both jet and turboprop in the same proportion. The only contributing factor showing a significant difference was for the cargo accidents where poor regulatory oversight was noted in **35%** of the jet accidents and in **24%** of the turboprop accidents.

28% occurred in North America. In **21%** technology and equipment was noted as a latent condition. In **67%** of those accidents improved monitoring and cross-checking could have been valid countermeasures.

Fatal accidents occurred during most of the flight phases, but are considerably more frequent during the initial climb (**29%**) and the approach (**25%**). Evidence of poor regulatory oversight was noted in **50%** of the accidents occurring during those flight phases.

Note: 29 cargo accidents in this period were not classified due to insufficient data; these accidents were removed from the count for the contributing factors and relationships of interest.

** The sum of the percentages may exceed 100% due to multiple contributing factors.*

Section 7

Cabin Safety

This section of the report highlights 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.

Four new definitions related to cabin safety end states were added in this edition of the Safety Report. Please note that 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 an aircraft incident or accident and when away from the boarding gates or aircraft stands (e.g., onto the runway or taxiway), only in non-life-threatening and non-catastrophic events.

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 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 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, for precautionary measures.

SUMMARY OF FINDINGS

Of the 73 total accidents in 2014:

- 39 occurred on jet aircraft
- 34 occurred on turboprop aircraft
- 16% resulted in fatalities
- Only 23% occurred on IATA-member airlines
- Only 36% occurred on IOSA-registered airlines

The accident rate for turboprop versus jet aircraft was almost four times higher, with 4.61 accidents per million flight sectors versus 1.27 for jet aircraft.

- 44% of the accidents resulted in an evacuation on land
- Only 1 accident resulted in an evacuation in water
- 12% of the accidents resulted in a hull loss with nil survivors
- 18% of the accidents resulted in an abnormal disembarkation
- 25% of the accidents resulted in a normal disembarkation (e.g., hard landings, ground damage, tail or bird strikes)

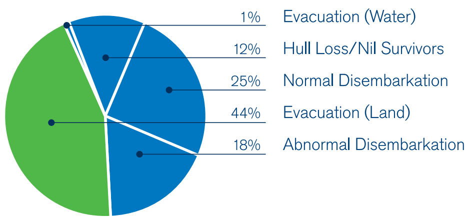
Out of the 73 total accidents in 2014, 43 occurred during the landing phase of flight. Of these 43 accidents:

- 1 involved fatalities
- 53% resulted in an evacuation (land)
- 26% resulted in a normal disembarkation
- 21% resulted in an abnormal disembarkation

2014 Accidents Cabin End States

	Normal Disembarkation	Abnormal Disembarkation	Land Evacuation	Water Evacuation	Hull Loss/Nil survivors
All	25%	18%	44%	1%	12%
IATA Member	41%	12%	41%	0%	6%
IOSA-Registered	42%	15%	35%	0%	8%
Fatal	0%	0%	17%	8%	75%
Hull Loss	0%	8%	50%	4%	38%
Jet	38%	23%	31%	0%	8%
Turboprop	9%	12%	59%	2%	18%

Cabin End States

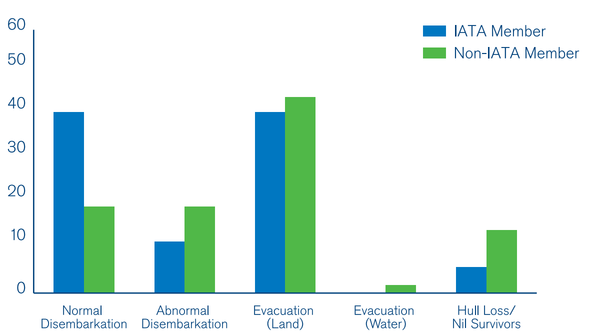


Cabin End States per Region

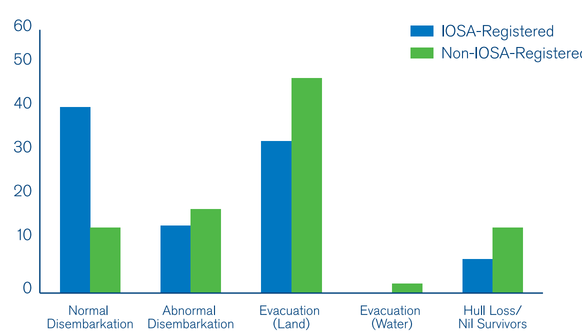
	AFI	ASPAC	CIS	EUR	LATAM/ CAR	MENA	NAM	NASIA
Total Number of Accidents	12	16	3	11	9	6	12	4
Abnormal Disembarkation	0%	31%	0%	27%	22%	0%	25%	0%
Normal Disembarkation	0%	44%	0%	45%	11%	0%	33%	25%
Evacuation (Land)	75%	13%	33%	18%	67%	83%	33%	75%
Evacuation (Water)	0%	0%	0%	0%	0%	0%	8%	0%
Hull Loss/ Nil Survivors	25%	13%	67%	9%	0%	17%	0%	0%

The graphs below show the distribution of cabin end states as a percentage of the total for each category being compared. For example, 70% of all fatal accidents involved a Hull Loss/Nill Survivor and nearly 15% resulted in an Evacuation (Land). Of the non-fatal accidents, nearly 45% resulted in an Evacuation (Land).

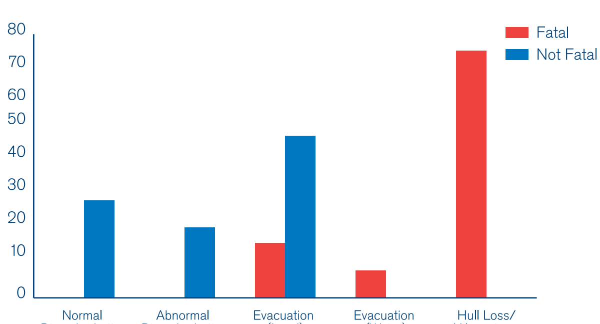
Cabin End States per IATA/Non-IATA Member



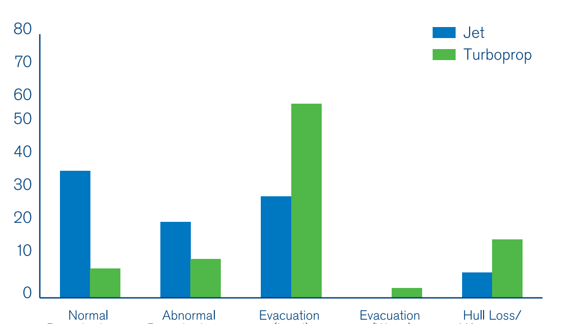
Cabin End States per IOSA/ Non-IOSA-Registered Airline



Cabin End States of Accidents Involving/ Not Involving Fatality



Cabin End States per Jet/Turboprop Aircraft

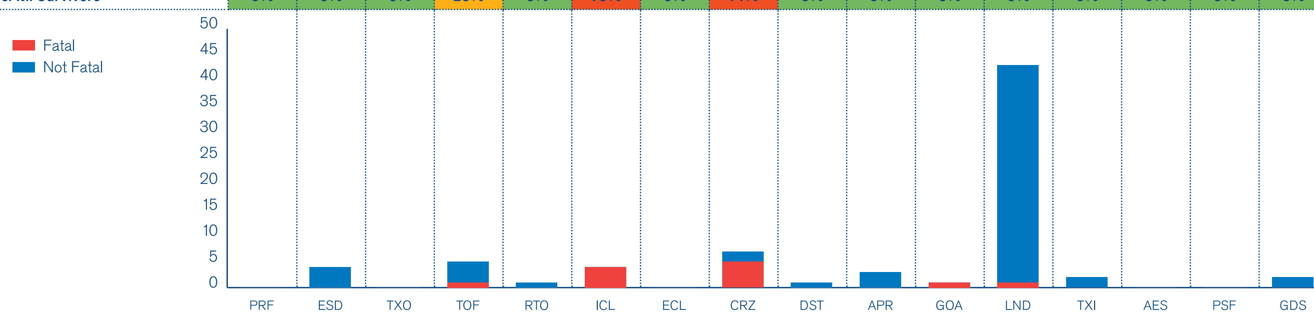


2014 Accidents
Cabin End States, cont'd

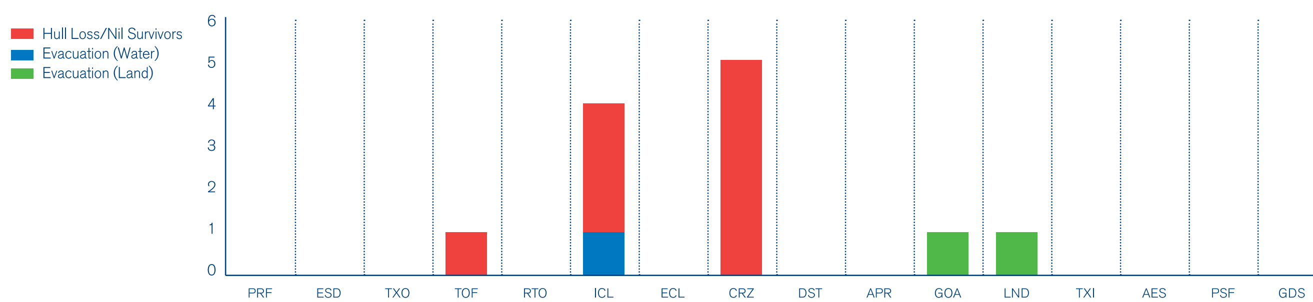
Cabin End States per Phase of Flight

The table below shows the distribution of cabin end states per phase of flight. The table's first row shows the total number of accidents in 2014 while the two graphs below give some additional contextual information. For example: there were 43 accidents in the landing phase; of those, one was fatal and involved an evacuation (land) - bottom graph. Also, of all the accidents on landing, 21% involved an abnormal disembarkation, 26% involved normal disembarkation and 53% involved evacuation (land). Additionally, 100% of the accidents that occurred during approach and during go-around resulted in an evacuation (land), however, there were three accidents on approach and only one on go-around.

	PRF	ESD	TXO	TOF	RTO	ICL	ECL	CRZ	DST	APR	GOA	LND	TXI	AES	PSF	GDS
Total Number of Accidents	0	4	0	5	1	4	0	7	1	3	1	43	2	0	0	2
Abnormal Disembarkation	0%	25%	0%	40%	0%	0%	0%	0%	0%	0%	0%	21%	50%	0%	0%	0%
Normal Disembarkation	0%	50%	0%	20%	0%	0%	0%	14%	100%	0%	0%	26%	0%	0%	0%	100%
Evacuation (Land)	0%	25%	0%	20%	100%	0%	0%	14%	0%	100%	100%	53%	50%	0%	0%	0%
Evacuation (Water)	0%	0%	0%	0%	0%	25%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Hull Loss/Nil Survivors	0%	0%	0%	20%	0%	75%	0%	71%	0%	0%	0%	0%	0%	0%	0%	0%



Cabin End States per Phase of Flight on Accidents Involving Fatalities



Accident End States and Cabin End States

	Abnormal Disembarkation	Normal Disembarkation	Evacuation (Land)	Evacuation (Water)	Hull Loss/ Nil survivors
Controlled Flight into Terrain	0	0	2	1	2
Gear-up Landing/Gear Collapse	3	0	14	0	0
Ground Damage	1	4	0	0	0
Hard Landing	1	8	1	0	0
In-flight Damage	5	3	0	0	0
Loss of Control In-flight	0	0	1	0	5
Off-Airport Landing/Ditching	0	0	1	0	0
Other End State	0	0	1	0	2
Runway/Taxiway Excursion	2	1	12	0	0
Tailstrike	1	2	0	0	0

CABIN SAFETY END STATES: FOCUS ON EVACUATIONS

Evacuation was the predominant category of cabin safety end states related to accidents during 2014. Correlations of interest related to this category include:

- In the majority of the evacuations on land (94%), all of the occupants survived. In nearly one-third (33%) of these accidents, the aircraft was either destroyed or damaged beyond repair (hull loss);
- 13% of the evacuations on land were initiated following a runway excursion;
- 15% of evacuations on land resulted from gear-up landings or gear collapses;
- 63% of the evacuations on land occurred on turboprops;
- Of the 12 accidents involving fatalities, 17% involved an evacuation on land.

INTERPRETATION FOR CABIN OPERATIONS

Silent Review

As 43 out of the 73 accidents occurred during landing, the need for cabin crew procedures to include conducting a "Silent Review" during take-off and landing should be reinforced.

The objective of the Silent Review for cabin crew is to mentally prepare themselves, to focus their attention on their safety-related duties and responsibilities and to be ready to act in the event of a planned or unplanned emergency. It enables cabin crew to respond and adapt more quickly and correctly in the event of an emergency. While the Silent Review can take various forms, it should contain all of the elements required to review evacuation duties and responsibilities. It is recommended that the Silent Review be included in both Initial and Recurrent training.

Mnemonics for the Silent Review are used by some operators to help cabin crew memorize and review some critical components. This example is known as "OLD ABC":

O – Operation of exits
L – Location of emergency equipment
D – Drills (e.g., brace for impact)

A – Able-bodied passengers and passengers with reduced mobility
B – Brace position
C – Commands

Another example of a mnemonic for the Silent Review is ALERT:

A – Aircraft type
L – Location
E – Equipment
R – Responsibility
T – Threat

Evacuations

Time is critical during an emergency and the cabin crew must react quickly and according to each specific situation as no two emergencies or evacuations are exactly the same. There are numerous factors that will affect the handling of the situation, (e.g., fire, smoke, ditching/water, slide/slide-raft malfunction, unusual aircraft attitude, landing gear collapse, severe structural damage, no communication from flight crew, etc.).

An evacuation is much more expeditious than a rapid deplaning. Evacuations are initiated by the Pilot-in-Command (PIC) or by the cabin crew in life-threatening or catastrophic situations when unable to contact the flight crew (i.e., the break-up of the fuselage, fire, etc.). If possible, before initiating an evacuation, the cabin crew should always try to advise the PIC. It is also important for an evacuation to be initiated only once the aircraft is no longer moving and the engines are turned OFF (particularly when using exits near aircraft engines).

The PIC will always assess each individual situation and may, as applicable to the situation, decide that there is no imminent threat to the safety of the on-board occupants. In this case, the PIC may decide that an evacuation is not required and would inform the cabin crew and passengers to deplane via the boarding doors (assisted either by internal aircraft or exterior stairs) after the aircraft incident or accident and while away from the boarding gates or aircraft stands (e.g., onto the runway, taxiway, or grass post-event of a runway excursion, etc.). This type of egress from the aircraft has been defined as an abnormal evacuation in this edition of the Safety Report.

For more information on the Silent Review and Emergency Procedures, please consult the IATA Cabin Operations Safety Best Practices Guide.

CABIN SAFETY

Cabin safety is a key area impacting operational safety and includes all of the activities that cabin crew accomplish during aircraft operations to maintain safety in the cabin. Cabin crews contribute to safe, effective and efficient operations in normal, abnormal and emergency situations. Upgraded cabin safety requirements, as well as improved cabin crew procedures and training, are among key factors contributing to positive developments in the prevention, management and survivability of incidents and accidents. As demonstrated in numerous events, cabin crew play an important role in preventing and handling serious incidents and accidents, including but not limited to: in-flight fires, unruly passengers, depressurizations, turbulence, inadvertent slide deployments and medical emergencies. It is for this reason that IATA focuses on cabin safety and continues to work with airlines and other industry stakeholders in developing and raising global safety standards and promoting the implementation of best practices to further elevate safety in all aspects of cabin operations.

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 and 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 on cabin safety information. In 2014, IATA hosted its very first IATA Cabin Operations Safety Conference and will be delivering a second event in 2015 in order to further elevate cabin safety worldwide.

Cabin Operations Safety Best Practices Guide (2nd Edition)

The Cabin Operations Safety Best Practices Guide was first released in 2014 and was recently updated in 2015. Recent edits to the 2015 edition include best practices on specific issues of concern to the industry, such as:

- Effective report writing
- Fatigue management and reporting
- The expanded use of passenger portable electronic devices (PED) on board
- Cabin crew checklist and amplified checklist for fires involving batteries and portable electronic devices (PED)
- Lithium battery fire prevention: PEDs inadvertently crushed or damaged in electronically adjustable seats
- 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 also creates guidelines specific to the health and safety of passengers and crew. In 2014, the following guidelines were published:

- Suspected communicable disease: General guidelines for cabin crew
- Suspected communicable disease: Cabin announcement scripts to be read by cabin crew to passengers prior to arrival
- Suspected communicable disease: Universal precaution kit

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

IOSA & CABIN OPERATIONS SAFETY

The IATA Operational Safety Audit (IOSA) manual includes Section 5 – Cabin Operations, containing 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).

STEADES™

The IATA Global Aviation Data Management (GADM) includes a business intelligence tool called STEADES™ that provides access to data, analysis and global safety trends on established key performance indicators in comparison to worldwide benchmarks. This 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 www.iata.org/steades.

IATA Cabin Operations Safety Task Force

The work of IATA is supported by our member airlines and delivers great results with their inputs. The IATA Cabin Operations Safety Task Force (COSTF) reviews all aspects of cabin operations to improve safety and operational efficiency. Members of the COSTF are representatives from IATA member airlines who are experts in the following areas: cabin safety, cabin operations, cabin safety training, accident/incident investigation, human factors and quality assurance.

The COSTF mandate includes supporting the work of the Accident Classification Task Force (ACTF) through the review of the cabin safety end states of accidents for Section 7: Cabin Safety of the Annual Safety Report. The ACTF wishes to thank the COSTF for their valuable contributions.

IATA Cabin Operations Safety Task Force (COSTF) Members (2013-2015)

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With special thanks to:
Thomas Gunther
AMERICAN AIRLINES

Section 8

Report Findings and IATA Prevention Strategies

TOP FINDINGS, 2010-2014

Of the 415 accidents between '10 and '14:

- 28% involved IATA members
- 21% were fatal
- 78% involved passenger aircraft, 19% involved cargo aircraft and 3% involved ferry flights
- 53% involved jet aircraft and 47% involved turboprops
- 41% resulted in a hull loss
- 59% resulted in substantial damage
- 59% occurred during landing
- 31% of the fatal accidents occurred during approach

	Top 3 Contributing Factors
Latent conditions (deficiencies in…)	1. Regulatory oversight 2. Safety management 3. Flight operations
Threats (Environmental)	1. Meteorology 2. Airport facilities 3. Ground-based nav aid malfunction or not available
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 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 2010 and 2014.

The following tables present the top five countermeasures 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 state responsible for oversight. These countermeasures are based on activities, processes and systemic issues internal to airline operation or state 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 (2010-2014)
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	**27%**
Overall crew performance	Overall, crew members should perform well as risk managers.	**22%**
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	**22%**
Monitor/ cross-check	Crew members should actively monitor and cross-check flight path, aircraft position and performance, systems and settings, as well as the actions of other crew members.	**15%**
Flight operations: Training systems	Operators should ensure proper training, adequate language skills, sufficient flight crew qualifications and experience, as well as necessary investment in training, assessments and resources such as manuals or CBT devices.	**13%**

COUNTERMEASURES FOR FLIGHT CREWS

Subject	Description	% of accidents where counter-measures could have been effective (2010-2014)
Monitor/ cross-check	Crew members should actively monitor and cross-check flight path, aircraft position and performance, systems and settings, as well as the actions of other crew members.	**15%**
Contingency management	Crew members should develop effective strategies to manage threats to a safe conclusion.	**9%**
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%**
Automation management	Automation should be properly managed to balance situational and/or workload requirements.	**4%**

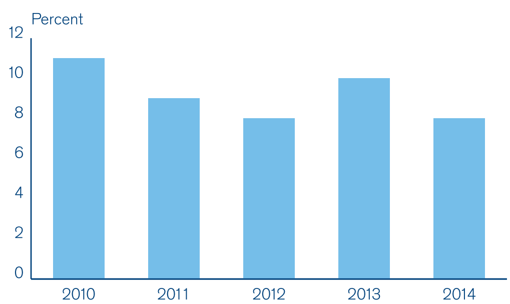
ACTF DISCUSSION & STRATEGIES

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 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 five years.



Loss of Control In-flight as a percent of total accidents

Discussion:

The last five years have seen a total of 38 LOC-I accidents (37 involved fatalities), with an average of approximately eight LOC-I accidents per year. Turboprop aircraft contributed to 66% of the LOC-I accidents, with the majority of these accidents happening on initial climb (7), approach (5) and cruise (5). When jet aircraft alone are considered, the accident counts are more evenly distributed across the different phases of flight, but accidents on initial climb were more frequent - Takeoff: 1, Initial Climb: 3, Cruise: 1, Approach: 2, Go-Around: 2, Landing: 2.

These accidents come from a variety of scenarios and it is difficult to single out the most critical one. 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 as well as stall recovery training, and approach-to-stall recovery training, need to be addressed on a regular basis.

Weather is also a key contributing factor to LOC-I accidents, with 42% of loss of control accidents having occurred in degraded meteorological conditions, with 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 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 LOC-I. 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, therefore it 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 piloting 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 takeoff.

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.

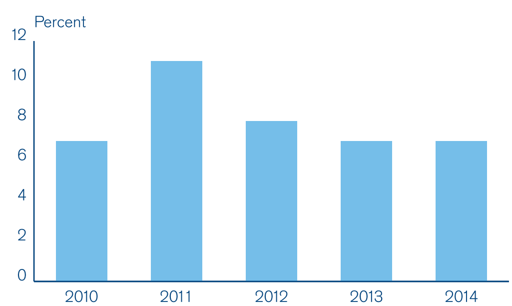
Operators should be aware of limitations of simulators to represent conditions out of the flight envelope as they have not been calibrated against flight data. The simulator response may differ from what is experienced in the aircraft, thus there is a possibility of providing negative training.

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:

Controlled Flight into Terrain (CFIT) continues to be an issue for the aviation industry. Five such accidents occurred in 2014, which is below the average for 2009 to 2013 (7.6). The graph below indicates the percentage of all accidents that were CFIT over the past five years.



Controlled Flight into Terrain as a percent of total accidents

The vast majority of CFIT accidents between 2010 and 2014 occurred during the approach phase, with 68% of the accidents on turboprops. In 2014, the numbers showed a slightly different behavior, with three out of the five CFIT accidents happening after takeoff and during initial climb.

There is, however, 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 52% of the CFIT accidents in the 2010-2014 period.

Discussion:

The lack of precision approaches has been noted as a major contributing factor to CFIT accidents. The implementation of precision 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 Area Navigation (RNAV) or Required Navigation Performance (RNP) approaches instead. Some airlines are discussing the operational impact of circling approaches and performing a risk evaluation. Forward knowledge of terrain through prior experience does not eliminate the need to adhere to Enhanced Ground Proximity Warning System (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 (barometric pressure adjustment to sea level) 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 such instances.

Recommendations to Operators:

Operators should support the concept of CANPA to reduce the risk of approach and landing CFIT, 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, original equipment manufacturer (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 crew resource management (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 Terrain Awareness Warning Systems (TAWS) or EGPWS computer, 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 using 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 CANPA for non-precision approaches.

CFIT accidents are occurring mainly in areas of the world where the use of 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 is 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 accidents in 2011 where the EGPWS database was never updated. These updates are critical as they include terrain and runway ends.

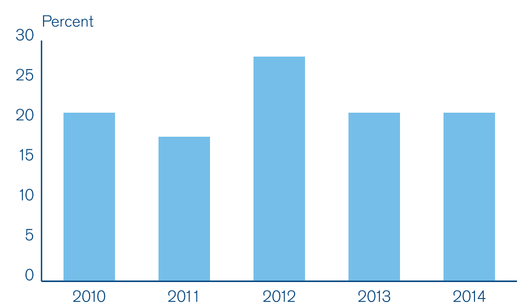
In some countries, an EGPWS supplier has to contact the state to get access to terrain data. Governments are encouraged to automatically provide manufacturers with their respective terrain data when a new airport opens.

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

Runway Excursions

Background:

In 2014, Runway Excursions contributed to 21% of the accidents. The following graph indicates the percentage of accidents classified as runway excursion over the previous five years. Runway excursions include landing overruns, takeoff overruns, landing veer-offs, takeoff veer-offs and taxiway excursions meeting the IATA definition of an accident. It is worth noting that not all runway excursions meet this definition. Therefore, other studies which include serious incidents may indicate a higher number of events.



Runway Excursions as a percent of total accidents

Over the five-year period from 2010 to 2014, 87% of runway excursions occurred in the landing phase of flight. There are many factors noted to have contributed to the runway excursions. Long, floated or bounced landings were noted in 50% of all runway excursion accidents during this period, while a continued landing after an unstable approach was a factor in 18% of the runway excursions.

Poor weather conditions (present in 43% of the accidents) and inadequate airport facilities still represent the largest components for environmental factors, while errors in the manual handling of the aircraft were noted to have contributed to 38% of runway excursions.

Aircraft malfunctions, such as brake or engine malfunction, are also factors that should be noted, having contributed to 20% 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 a 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 minimum decent altitude/decision height - 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:

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

These highlights could work as means for avoiding runway excursions:

1. Landing in the touchdown zone
2. Defining the touchdown aiming point as the target
3. Parameters of stable approach based on the manufacturer information
4. Deviation callouts by the Pilot Monitoring
5. The use of metrics to measure SMS effectiveness and ensure continual improvement
6. Implement a flight data monitoring system
7. Validate the (FDM) parameters with the Flight Operations department based on manufacturer's criteria

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 specify 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 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 that may result in actual performance that is less than predicted.

Operators are advised to conduct a field survey to determine the actual landing and takeoff 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 measure actual takeoff/landing distances compared with calculated takeoff/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 rejected landings in the case of long landings
3. Measure the long landings in 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 promote 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 Runway End Safety Area (RESA), Engineered Material Arrestor System (EMAS), 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 the 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.

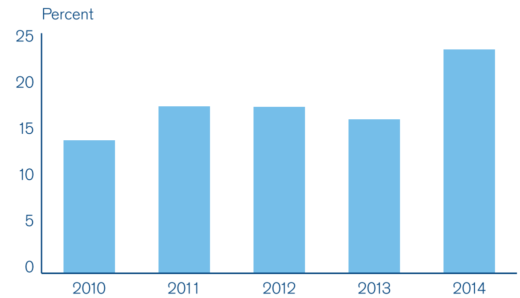
Airports should refrain from publishing requirements limiting the use of reverse thrust due to noise issues because this practice contributes to runway excursions as crews do not utilize the full capability of stopping devices. This is particularly true at airports with high-intensity operations.

Aircraft Technical Failures and Maintenance Safety

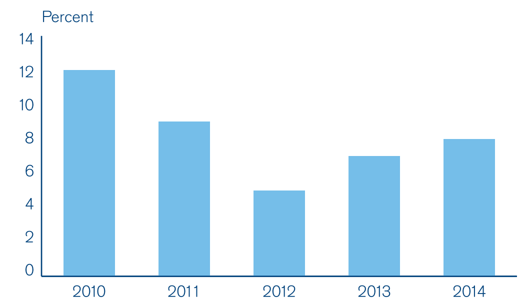
Background:

2014 saw an increase in the number of accidents involving a gear-up landing or a gear collapse. This accident category has surpassed runway excursions as the top accident category for the year. In 14 accidents, aircraft malfunction was a contributing factor, while six involved a maintenance-related event.

Of the 17 gear-up landing/gear collapse accidents, maintenance operations and non-adherence to SOPs were contributors in four accidents (24%), while deficiencies in the training systems were cited in two of those accidents.



Gear-Up Landing/Gear Collapse as a percent of total accidents



Maintenance Issues as a percent of total accidents

Discussion:

Commercial pressures have forced virtually all airlines to outsource 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 minimum equipment list (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 the maintenance 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, 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 their root cause. 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 (MRM). Line Oriented Safety Audits (LOSA) can be developed for maintenance and ramp operations. Fatigue Risk Management Systems (FRMS) can also 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 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.

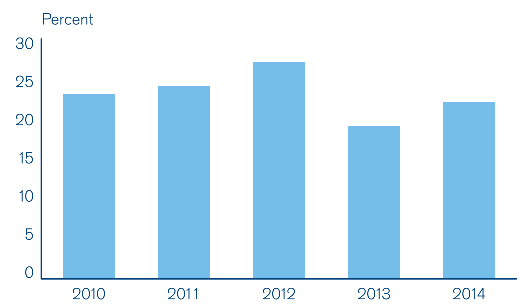
The Flight Safety Foundation (FSF) has published a FCF Compendium document containing information that can be used to reduce risk. The information contained in the guidance document is generic and may need to be adjusted to apply to an airline's specific aircraft. Operators are encouraged to use this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

MROs and Airline Maintenance departments should implement a LOSA system for their maintenance activities.

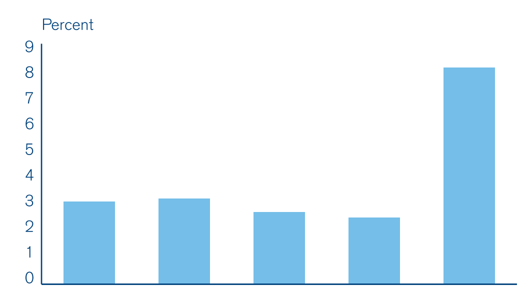
Continuation of Airline Operation during Severe Weather

Background:

Airline operations may be completely suspended by severe weather in some parts of the world. Meteorological threats were identified as factors in 31% of accidents in 2014 and 27% of accidents during the period of 2010 to 2014. Unnecessary weather penetration was a factor in 8% of the accidents in 2014, a large increase when compared to previous years when the average was of about 3%. Airports are encouraged to provide necessary meteorological information to Air Traffic Service (ATS) units, airline operators, flight crew members, dispatchers and airport management in a timely and accurate manner. 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 phenomena 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.



Weather-related accidents as a percent of total accidents



Unnecessary Weather Penetration-related accidents as a percent of total accidents

Discussion:

Weather can have 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).

An airport'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 airports need to issue alerts for low-level windshear 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 the airport'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 airports need to have a meteorological office that issues alerts of low-level windshear 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 SOP 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.

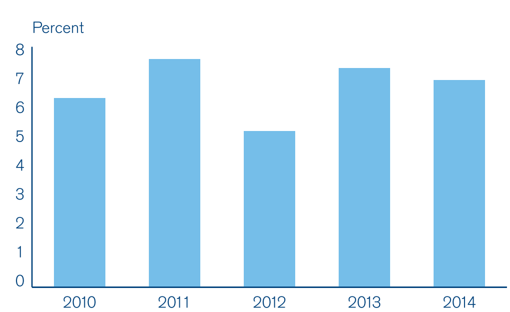
Specific call outs of information or decision requirements at critical points in the flight may help the first officer to overcome the social gradient between the crew members. Properly developed SOPs with clear instructions may empower first officers to take over the flight controls when the situation 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 7% of the accidents between 2010 and 2014. 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.



Failure to go around after destabilized approach as a percent of total accidents

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 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 mindset 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 to train pilots for a correct reaction on the heads-up illusion. As preventive means, crews are recommended 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 lost due to a 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 increase initial go-around altitudes wherever possible to give flight crews additional time to both reconfigure the aircraft and adjust to their new situation.

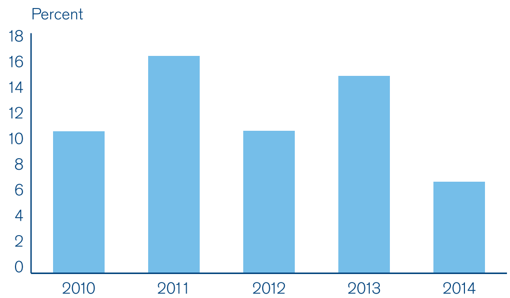
Industry should support the development of operationally feasible simulators which can generate sustained g-forces for generic go-around training with regard to somatogravic illusions.

Air traffic controllers (ATC) 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 as well as 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:

2014 showed an improvement in the number of accidents caused by ground damage in relation to their contribution to the overall number of accidents: from 15% in 2013 to 7% in 2014. The graph below indicates the percentage of ground damage accidents over the previous five years. This downward trend, however, needs 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.



Ground Damage as a percent of total accidents

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 at 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
- 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 airport 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 at all airports.

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. 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 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.

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.

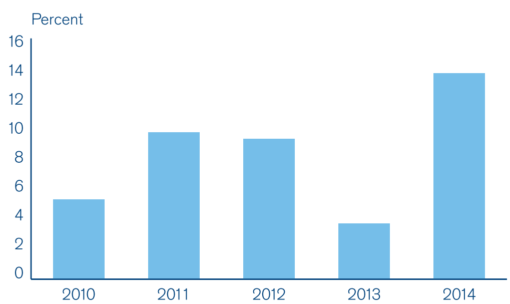
Manufacturers are asked to investigate the use of technology to assist crews in determining the proximity of aircraft to obstacles. Similar technology has been available in automobiles for several years and would be extremely useful in low-visibility situations or when the pilot's view is obstructed.

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 (Automatic Dependent Surveillance – Broadcast) out and in will provide the necessary ground collision prevention in conjunction with well-engineered ramps and taxi lanes.

Hard Landings

Background:

In the 2010 to 2014 period, 2014 represented a record high in terms of hard landings, with close to 14% of accidents involving a hard landing. A graph of the previous five years' percentage of accidents due to hard landings is included below.



Hard Landing as a percent of total accidents

Frequent contributing factors to hard landings in the last five years were meteorological factors, typically related to wind or windshear (86% of all hard landing accidents), and the failure to go-around after the approach became unstable (28% of all hard landing accidents), with the manual handling of the aircraft by the crew representing 70% of the flight crew deficiencies.

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. It is important 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 report, airlines are recommended to modify their approach procedures to include a callout 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 autopilot. 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 financial pressure on 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 crew 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 the necessary operational information about possible diversion alternatives 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 option 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.

FINAL STATEMENTS

With accident rates at near historic lows, questions continue to be asked about how safety can be improved with such a limited number of accidents. The answer is still common industry knowledge: focus on incidents.

The ACTF recommends that operators continue to develop their use of statistical analysis of incident data to identify areas of increased risk in their operation and take appropriate action to mitigate those risks. Continuing work also needs to be done in developing a working predictive analysis model that can be used to evaluate incidents and develop transfer probabilities of the incidents becoming accidents.

In 2014, there were a number of aviation accidents where extreme weather played a significant role. Most prominent phenomena are thunderstorms, turbulence, icing, snow and tropical storms. Lesser known are space weather, which can have an influence (e.g., on the operation of Wide Area Augmentation System (WAAS), and ice crystal icing. The widespread term “All Weather Operations” should not imply that airline operations can be sustained under all circumstances. Even the latest generation of aircraft is susceptible to weather. The goal should be to have timely and accurate weather information available at all times, which is standardized to the extent that it can be interpreted quickly by flight crew.

Recommendations to Operators:

- Support means to get weather information into the flight deck in real-time, filtered and in the appropriate layout which is easy to interpret
- Support development of advanced technology for forecasting, and real time presentation of weather
- Support promulgation of meteorological phenomena to aircrew
- Support intelligent filtering systems so that flight crews get timely information that applies to their specific flight
- Encourage development of technology that allows flight dispatch to gain situational awareness regarding hazardous weather phenomena along the planned route, adjust the route and assist air crews in decision making (e.g. fuel uplift) prior to flight
- Encourage development of technology that allows ATC to gain situational awareness regarding hazardous weather phenomena, not only in the vicinity of airports, but also along the route so as to be able to assist air crews
- Encourage ICAO to standardize presentation of weather phenomena, including use of colors
- Encourage ICAO to promote visualization of weather information in such a way that human factor considerations are fully taken in account
- Encourage training tailored to the specific type of weather radar utilized by pilots so that maximum benefit can be taken from the equipment
- Encourage training in the use of present as well as new weather information/products

Recommendations to Industry

All industry partners should be aware of the acute responsibility to improve products based on the latest available technology and scientific evidence. Industry (i.e., OEMs, regulators, airport authorities, etc), should embrace emerging technologies and be attuned to proven advances in safety enhancements, recognizing and acknowledging a balance between safety and commercial viability is a key requirement.

These are important for any business and it is easy to defend such concepts because of the industry´s demand for cross-type commonality. Additionally, a high degree of honesty and open-mindedness (concerning scientific evidence) is required to further reduce the risk of aviation accidents.

Section 9

All Weather Operations

Respecting Nature

BACKGROUND

The good safety record of commercial aviation over the last decades is due, in large part, to the introduction of technology, be it for safer landing guidance in low-visibility conditions or more reliable systems throughout the airplane. Other recent safety measures have focused on crew resource management (CRM), basic flying skills and other aspects of ´human factors´. What role does meteorology (MET) play in aviation safety? The following highlights some key aspects of the relationship between aviation and MET. We will examine various aspects of weather and the challenges faced by pilots, dispatchers, airlines and the aviation system as a whole.

THE IMPORTANCE OF WEATHER IN AVIATION SAFETY

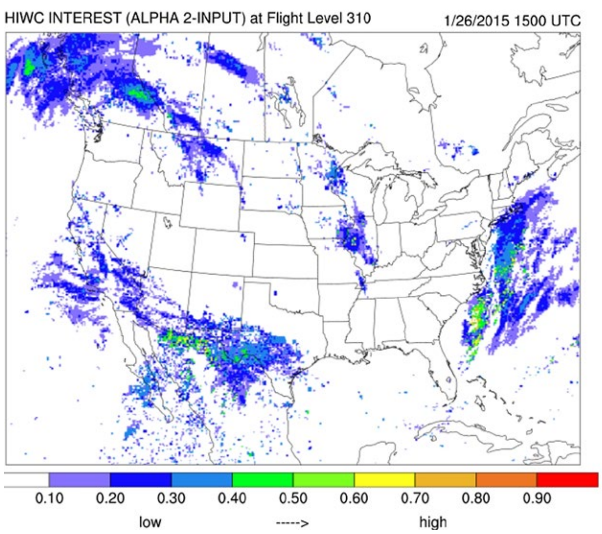
One should not assume from the title of ICAO DOC 9365, All Weather Operations, that operations during all weather conditions are possible. Nor should one take from the fact that standard weather documentation has seen little change in recent years that meteorology is not important. Quite the contrary, MET, or weather, is very high on the list of contributing threats identified in IATA´s safety report on accidents. Furthermore, year after year, it is the single largest cause of delays in many areas of the world. Pilots know that weather can affect all phases of flight: takeoff, departure, cruise, descent and landing. ICAO has recognized the need to modernize Annex 3, Meteorological Service for International Air Navigation, in order to support the Global Air Navigation Plan.

A number of larger airports in Europe and North America are equipped with precision lateral and vertical approach guidance systems, but in other regions and at many smaller airports only non-precision approach procedures are available. Forty one (41%) of Controlled Flight into Terrain (CFIT) accidents were shown to involve the lack of a precision approach. Weather was certainly an important contributing factor during these accidents. While installing more precision (ILS, GLS or PBN) procedures is part of the solution – it is time to consider that some approaches should not be attempted when a combination of challenging weather conditions is present - regardless of the procedure available. Strong rain and wind, in combination with a low ceiling and low visibility, especially at night, should lead to a diversion rather an approach attempt. It is wise to respect nature, and consider that a combination of weather factors can be a serious threat to safety that needs to be mitigated by increased landing minima or a diversion to another airport.

Decision making with regards to weather requires good situational awareness as well as recent, easy-to-interpret information. Some key aspects of this were described in an IFALPA document for ICAO's 2014 Meteorology Divisional Meeting, which can be found on www.icao.org.

Icing

Icing conditions can affect aircraft in different ways: loss of lift, reduced stabilizer effectiveness or, at high altitude, engine damage. Meteorologists have difficulty giving reliable guidance on where to expect dangerous icing conditions, be it at low or high altitudes. While there are icing forecasts for some areas of the globe, they are difficult to interpret and even more difficult to heed, as the designated areas are large or irregular in shape, or both. There are also experimental high-altitude ice crystal forecasts, but more development time is needed to perfect them. Yet, even when they are available, it will still be wise to respect nature, and operate only where safely possible.



High altitude icing (image provided by the High Ice Water Content Product Development Team at the National Center for Atmospheric Research under sponsorship of the Federal Aviation Administration)

Thunderstorms

Convective systems, or thunderstorms, entail risk of extreme turbulence, hail, wind shear, downbursts and more. Weather radar helps avoid the worst of these risks, but has its limitations. One such limitation is that some forms of downbursts may not be detectable by radar. Also, severe turbulence can occur in clear air around a thunderstorm cell without showing up on radar. Pilots will avoid thunderstorms whenever possible, but as recently as early 2015 there were reports of hail damage to commercial aircraft. Large mesoscale convective systems over oceans may be picked up on weather radar only when an aircraft is effectively in a cul-de-sac, left without a good course to steer. Tops of storms can be impossible to see at night and may be difficult to detect on radar. Yet, they can contain significant turbulence that can cause injuries to passengers and crew who do not have their seatbelts buckled.

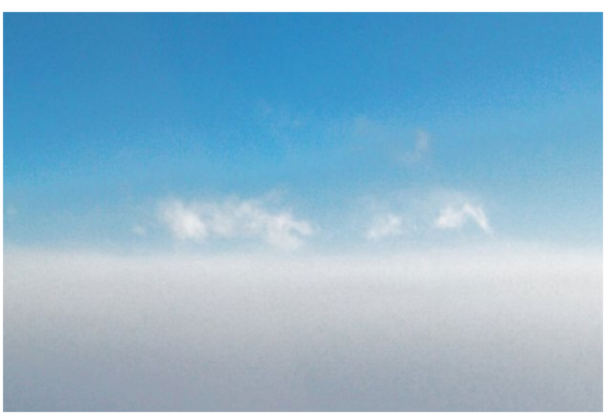
Forecasting the development and decay of thunderstorms with a high degree of geographic precision is currently beyond the capabilities of meteorologists. Therefore, significant weather (SIGWX) charts provided to pilots are often inaccurate. Real-time satellite images, showing height, precipitation and intensity information, all uplinked to the cockpit, would help. Introduction of such systems is just starting and will take time to roll out. Meanwhile, it is wise to respect nature by circumnavigating thunderstorms and considering thunderstorm avoidance from the flight-planning stage onwards.

Severe thunderstorms over Brazil, December 2014

Turbulence

Turbulence makes it into the headlines all too often, particularly when passengers and crew are injured or airplanes are damaged. Pilots know they should avoid areas of severe turbulence, but the tools to accomplish this are not reliable. Even the most modern, colorful forecasts are wrong more often than not. One frequent example is showing areas of severe turbulence along the Jet Stream over the North Atlantic when there are none. Therefore, pilots and dispatchers are often left on their own, interpreting limited clues as best as they can.

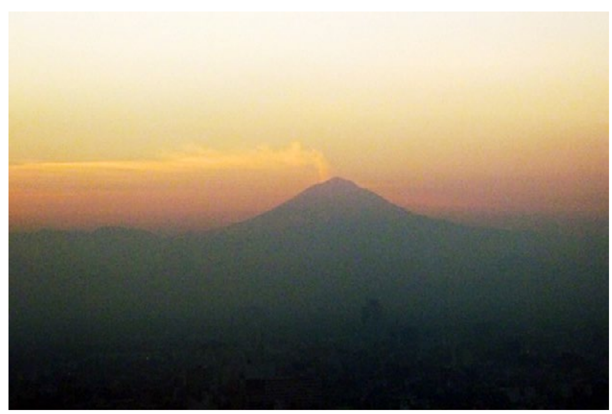
An important consideration is changing global weather patterns. For example, wind speeds in the jet streams of the northern hemisphere and their meandering are on the rise. It is expected that climate change will make turbulence encounters more likely in the future. Unexpected forms of turbulence, such as mountain waves over Greenland, will become more common. The reliability of turbulence forecasting needs to be improved and detection systems (e.g., lidar) should be installed in aircraft. However, until this is achieved, it is up to pilots and dispatchers to respect nature, and fly with extra margins with regards to speed, altitude and route when turbulence is forecast. The picture below shows cloudlets encountered during a flight with severe turbulence reported at higher altitude. They may be an indication or a clue to pilots.



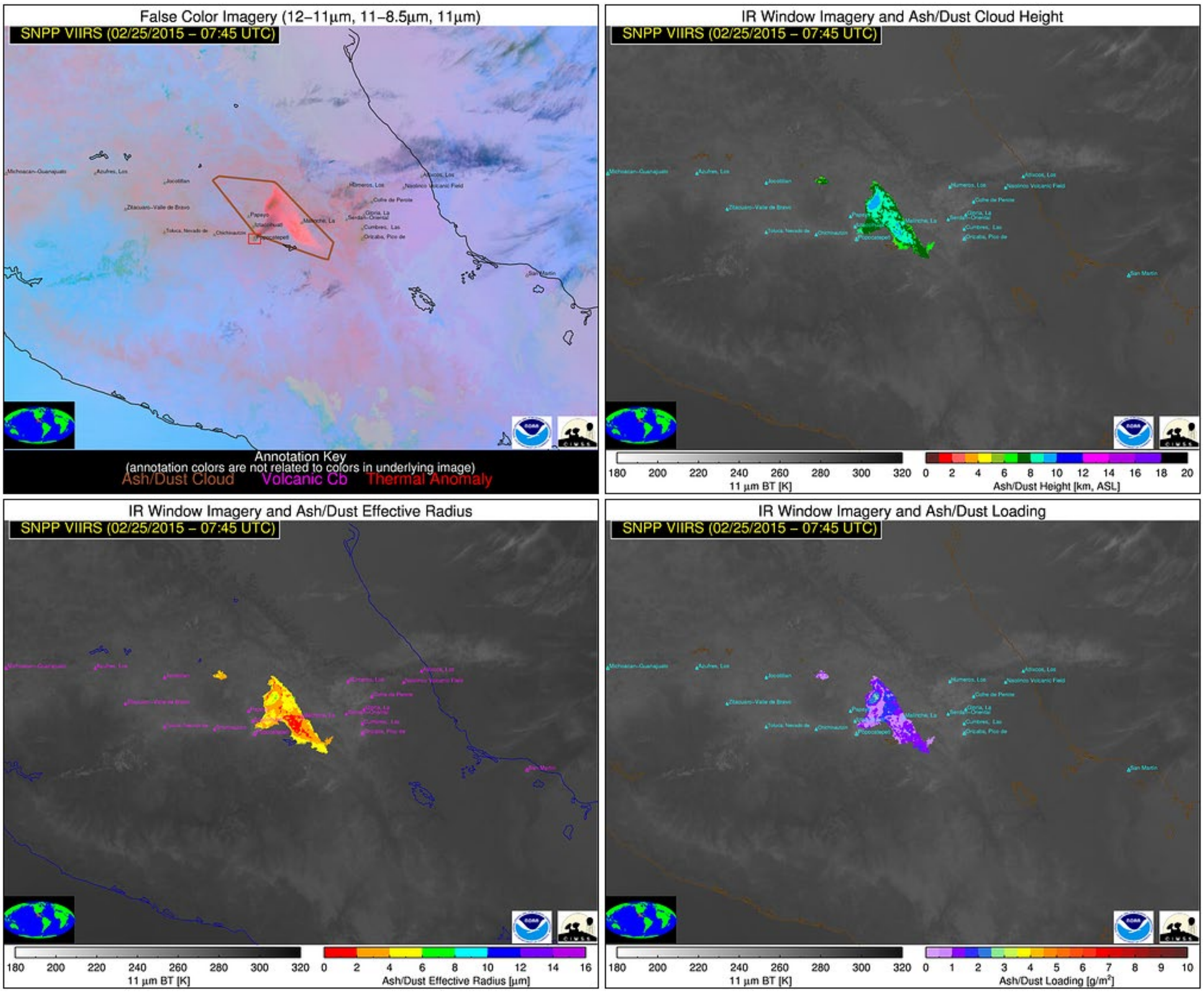
Clouds present during a severe turbulence encounter at high altitude

Volcanic Ash

There is a surprising lack of hard data, testing and standards regarding the impact of volcanic ash on commercial aviation. Currently, there is no certification regarding an acceptable level of ash tolerance. It is almost impossible to find the contents of a safety risk assessment (SRA) that determines whether or not an airline will be allowed to fly. Some global standards and rules are in place – and continue to be developed by ICAO – but regional differences are huge and progress is slow. Once again, it is up to pilots and dispatchers to show respect for nature by steering well clear of volcanic ash clouds.



Popocatepetl volcano eruption (February 25, 2015)



Display of ash identification, ash height, ash size and ash mass loading for Popocatepetl volcano eruption (25 February 2015)
(Credit: Mike Pavolonis NOAA/NESDIS)

Space Weather

Space weather describes the influence of cosmic radiation, particles and solar activity on the natural environment of the Earth and human technology. Solar storms can create unusually high levels of ionizing radiation. This can affect flight crews and passengers, especially at higher latitudes. Radiation can also impact aircraft avionics, power grids and the ionosphere. The ionosphere lies between 75 and 1,000 kilometers above the Earth and is vital for short-wave communications as well as all satellite and navigation signals.

Not many airlines have guidance with respect to space weather in their operations manual, and ICAO is still in the process of developing and agreeing on guidance material for space weather. In short, it is necessary to show respect for nature by being in touch with specialist organizations that can provide early warnings and expert information. As usual, it is up to pilots to be ready to take instant action should space weather adversely impact the aircraft or its navigation/communication systems.

Respect Nature

Strong winds, rain, fog, convective systems, icing, turbulence, volcanic ash and space weather: all are forms of weather, of nature, that have been factors in aviation accidents and incidents. After addressing CRM, training issues and CFIT, MET may be the next frontier in the struggle to improve aviation safety. Pilots and dispatchers need ongoing education on how to keep their aircraft safe from adverse weather conditions. They also urgently need immediate access to the most up-to-date weather information available – from flight plan preparation to engine shutdown. Advanced knowledge of weather can pay big dividends in increased safety. Ignoring weather, not respecting nature, is a path to failure.

Author: Klaus Sievers - Captain B747, IFALPA ATS Committee

Image courtesy of Bombardier

Section 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, 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.

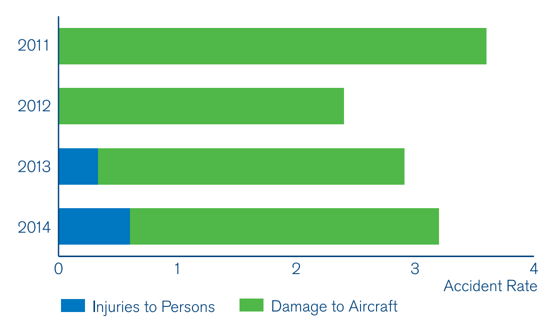
The GSIE developed a harmonized accident rate beginning in 2011. This was accomplished through close cooperation between ICAO and IATA to align accident definitions, criteria and analysis methods used to calculate the harmonized rate, which is considered a key safety indicator for commercial aviation 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 122 accidents were considered as part of the harmonized accident criteria for 2014. These include scheduled and non-scheduled commercial operations, including ferry flights, for aircraft with a maximum certificated takeoff weight above 5700kg. The GSIE harmonized accident rate for the period from 2011 (the first year the rate was calculated) to 2014 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



Note: see Annex 1 - Definitions for the difference between IATA and ICAO's accident definition.

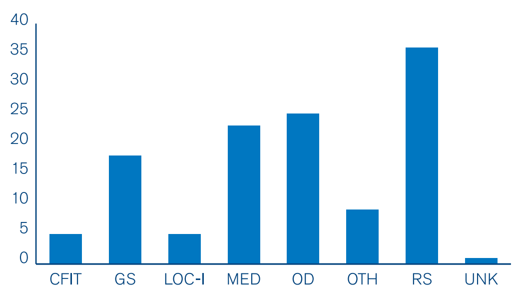
Definitions and Methods

In order to build upon the harmonized accident rate presented in recent 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 they relate to the Commercial Aviation Safety Team/ICAO Common Taxonomy Team (CICTT) occurrence categories can be found in Appendix 3.

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:



Number of Accidents

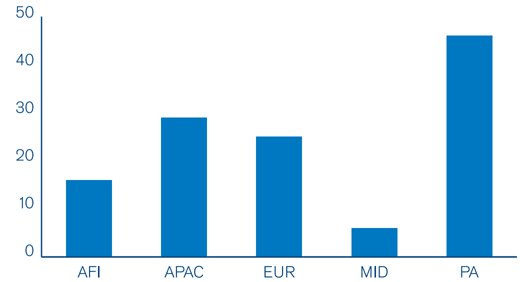
Accident Categories

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)

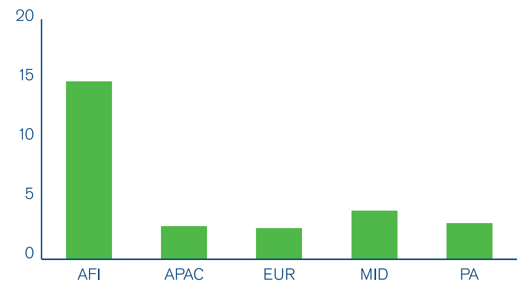
Full details of categories can be found at the end of this section.

Accident 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:



Number of Accidents



Accident Rate

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 in direct contact with the aircraft. Includes turbulence-related injuries, injuries to ground staff coming into contact with the aircraft and on-board 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
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.)

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

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.

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.

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
	Panama
	Paraguay
	Peru
	Saint Kitts and Nevis
	Saint Lucia

Region	Country
	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.

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 (E-GPWS, 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

Annex 3

2014 Accidents Summary

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	OPERATOR REGION	LOCATION
03-01-14	Boeing	B737-800	N8327A	Southwest Airlines	NAM	Las Vegas - McCarran International, NV, USA
05-01-14	Boeing	B767	HS-BKE	Saudia	MENA	Mohammad Bin Abdulaziz Airport, Madinah, Saudi Arabia
05-01-14	Airbus	A320	VT-ESH	Air India	ASPAC	Jaipur Airport, Jaipur, India
07-01-14	Fokker	F50	C5-SSA	South Supreme Airlines	AFI	Aweil Airport, Aweil, South Sudan
08-01-14	Saab	Saab 340	C-FPAI	Provincial Airlines	NAM	Stephenville, Newfoundland, Canada
10-01-14	Fairchild	Metro III	C-FJKK	Carson Air Ltd	NAM	Regina, Saskatchewan, Canada
18-01-14	Boeing	DC-9	XA-UQM	Aeronaves TSM	LATAM	Saltillo - Plan de Guadelupe, Mexico
26-01-14	Boeing	B737-300	ZK-TLC	Airwork	ASPAC	Honiara - Henderson, Solomon Islands
28-01-14	Saab	Saab 2000	HB-IZG	Darwin Airline	EUR	Paris - Charles de Gaulle, France
29-01-14	Bombardier	Dash 8-200	OY-GRI	Air Greenland	EUR	Ilulissat, Greenland
01-02-14	Boeing	B737-900	PK-LFH	Lion Air	ASPAC	Surabaya - Juanda, Indonesia
01-02-14	Boeing	B737-800	PK-GFW	Garuda Indonesia	ASPAC	Surabaya - Juanda, Indonesia
02-02-14	Airbus	A320	EY-623	East Air	CIS	Kulyab, Tajikistan
04-02-14	Xian	MA-60	B-3455	Joy Air	NASIA	Zhengzhou, China
10-02-14	Boeing	B747-400	N901AR	Centurion Air Cargo	NAM	Rio de Janeiro - Antonio C Jobim Int'l, Brazil
13-02-14	Airbus	A320	9V-JSN	Jetstar Asia	ASPAC	in flight, over Java, Indonesia
16-02-14	Boeing	MD-80	N499AA	American Airlines	NAM	Baltimore - Washington International, MD, USA
17-02-14	Boeing	B737-800	G-GDFC	Jet2	EUR	Funchal - Madeira, Portugal
20-02-14	ATR	ATR 72	VH-FVR	Virgin Australia	ASPAC	in flight,(near) Sydney, New South Wales, Australia
22-02-14	Boeing	B737-800	OK-TVT	Travel Service Airlines	EUR	Terceira - Lajes, Azores

	PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
	LND	Passenger	Jet	Substantial Damage	Tailstrike during landing
	APR	Passenger	Jet	Substantial Damage	Single main gear-up landing
	LND	Passenger	Jet	Substantial Damage	Touched down left of runway and wing struck trees
	LND	Passenger	Turboprop	Substantial Damage	Overran runway resulting in nose-gear collapse
	LND	Passenger	Turboprop	Hull Loss	Struck snow and veered-off runway
	LND	Cargo	Turboprop	Substantial Damage	Runway overrun on landing
	LND	Cargo	Jet	Hull Loss	Runway excursion and nose-gear collapse
	LND	Cargo	Jet	Substantial Damage	Undercarriage collapse during landing
	LND	Passenger	Turboprop	Substantial Damage	Bounced landing and nose-gear collapse
	LND	Passenger	Turboprop	Hull Loss	Hard landing and gear collapse during landing in strong wind
a	LND	Passenger	Jet	Substantial Damage	Hard bounced landing
a	LND	Passenger	Jet	Substantial Damage	Damage from burst tire during landing
	LND	Passenger	Jet	Hull Loss	Overran runway into snowbank
	LND	Passenger	Turboprop	Substantial Damage	Nose-gear collapse
	ESD	Cargo	Jet	Substantial Damage	Engine struck by tug during push-back
	CRZ	Passenger	Jet	Substantial Damage	Engine damage from ash cloud
	ESD	Passenger	Jet	Substantial Damage	Struck by tug while preparing for departure
	LND	Passenger	Jet	Substantial Damage	Tailstrike in windshear
	DST	Passenger	Turboprop	Substantial Damage	Birdstrike damage
	LND	Passenger	Jet	Substantial Damage	Hard landing

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	OPERATOR REGION	LOCATION
24-02-14	Let	Let 410	5H-ZAP	ZanAir	AFI	Penba-Zanzibar, Tanzania
25-02-14	Embraer	EMB-120	D2-FFZ	Guicango	AFI	Lucapa, Angola
04-03-14	Airbus	A320	LV-BET	LAN Argentina	LATAM	Buenos Aires - Aeroparque Jorge Newbery, Argentina
08-03-14	Boeing	B777	9M-MRO	Malaysia Airlines	ASPAC	Missing,Southern Indian Ocean,International waters
09-03-14	ATR	ATR 42	C-FJYV	Calm Air	NAM	Churchill, MB, Canada
13-03-14	Airbus	A320	N113UW	US Airways	NAM	Philadelphia - International, PA, USA
18-03-14	Airbus	A340	D-AIHR	Lufthansa	EUR	Tokyo - Narita/New Tokyo International, Japan
18-03-14	Airbus	A330	DQ-FJV	Fiji Airways	ASPAC	Sydney - Kingsford Smith Int'l, NSW, Australia
28-03-14	Fokker	F100	PR-OAF	Avianca (Brazil)	LATAM	Brasilia - International, Brazil
11-04-14	Embraer	EMB-190	5Y-FFC	Kenya Airways	AFI	Dar-es-Salaam - International, Tanzania
20-04-14	Fokker	F50	5Y-VVJ	Blue Bird Aviation	AFI	Guriceel, Somalia
29-04-14	Boeing	B737-400	EI-STD	Air Contractors	EUR	Derby - East Midlands Int'l, United Kingdom
08-05-14	Boeing	B737-400	YA-PIB	Ariana Afghan Airlines	MENA	Kabul, Afghanistan
09-05-14	Boeing	B737-400	YV2946	Avior Airlines	LATAM	Panama City - Tocumen International, Panama
10-05-14	Fokker	F100	EP-ASZ	Iran Aseman Airlines	MENA	Zahedan, Iran
10-05-14	Fokker	F100	5N-SIK	IRS Airlines	AFI	Kwasi Posa, (near) Magaria, Niger
30-05-14	BAE Systems (Hawker Siddeley)	BAE 748	C-FFFS	Wasaya Airways	NAM	Pickle Lake, Ontario, Canada
30-05-14	ATR	ATR 42	PR-TKB	Total Linhas Aereas	LATAM	Coari, Brazil
04-06-14	Boeing	B777	VT-ALT	Air India	ASPAC	Newark - Liberty International, NJ, USA
06-06-14	Airbus	A320	B-6851	Spring Airlines	NASIA	Xiamen - Gaoqi, China
20-06-14	Boeing	B767	N768NA	Omni Air International	NAM	Kabul, Afghanistan
28-06-14	Boeing	B737-800	EI-DLJ	Ryan Air	EUR	London - Stansted, United Kingdom
02-07-14	Fokker	F50	5Y-CET	Skyward International Aviation Ltd	AFI	Utawala district, Nairobi, Kenya
04-07-14	Airbus	A320	LZ-MDB	Air VIA	EUR	Leipzig-Halle - Schkeuditz, Germany
07-07-14	Airbus	A320	9M-AQA	AirAsia	ASPAC	Bandar Seri Begawan - Brunei Int'l, Brunei
09-07-14	Antonov	An-26	HK-4728	Aer Caribe	LATAM	Otu, Colombia
20-07-14	ATR	ATR 72	S2-AFN	United Airways	ASPAC	Cox's Bazar, Bangladesh

PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
LND	Passenger	Turboprop	Substantial Damage	Runway excursion after brake failure
LND	Passenger	Turboprop	Hull Loss	Runway veer-off
GDS	Passenger	Jet	Substantial Damage	Horizontal stabilizer struck by other aircraft
CRZ	Passenger	Jet	Hull Loss	Aircraft missing
TXI	Passenger	Turboprop	Hull Loss	Gear collapsed during taxi-in
RTO	Passenger	Jet	Hull Loss	Nose gear collapse after rejected takeoff
LND	Passenger	Jet	Substantial Damage	Hard landing
LND	Passenger	Jet	Substantial Damage	Hard landing
LND	Passenger	Jet	Substantial Damage	Nose gear-up landing
LND	Passenger	Jet	Substantial Damage	Runway veer-off
LND	Cargo	Turboprop	Hull Loss	Left wing failed after runway overrun onto rough ground
LND	Cargo	Jet	Substantial Damage	Left main gear collapse during landing roll
LND	Passenger	Jet	Hull Loss	Overran runway during landing
TOF	Passenger	Jet	Substantial Damage	Damage from burst tire during takeoff
APR	Passenger	Jet	Substantial Damage	Left main undercarriage failed to extend
CRZ	Ferry	Jet	Substantial Damage	Emergency landing in desert
TXI	Cargo	Turboprop	Substantial Damage	Nose gear collapsed during taxi-in
TOF	Passenger	Turboprop	Substantial Damage	Struck tapir during takeoff
GDS	Passenger	Jet	Substantial Damage	Struck by catering vehicle while parked
LND	Passenger	Jet	Substantial Damage	Aircraft touched off the edge of runway. Tail Strike during go around.
LND	Passenger	Jet	Substantial Damage	Tailstrike during landing
ESD	Passenger	Jet	Substantial Damage	Struck winglet of aircraft during push back
ICL	Cargo	Turboprop	Hull Loss	Lost control after takeoff
LND	Passenger	Jet	Substantial Damage	Hard landing leading to bounced landing and tailstrike
LND	Passenger	Jet	Substantial Damage	Runway excursion
LND	Passenger	Turboprop	Substantial Damage	Nose-gear failed to extend
LND	Passenger	Turboprop	Substantial Damage	Nose gear collapse after landing

DATE	MANUFACTURER	AIRCRAFT	REGISTRATION	OPERATOR	OPERATOR REGION	LOCATION
23-07-14	ATR	ATR 72	B-22810	TransAsia Airways	NASIA	Xixi village, Huhsi Township, Chinese Taipei
24-07-14	Boeing	MD-80	EC-LTV	Swiftair	EUR	SE of Gossi, Mali
07-08-14	Antonov	AN-26	HK-4730	Aer Caribe	LATAM	San Jose del Guaviare, Colombia
10-08-14	Bombardier	Dash 8-100	N815EX	Piedmont Airlines	NAM	Philadelphia, USA
10-08-14	Antonov	An-140	EP-GPA	Sepahan Airlines	MENA	Azadi district, Tehran, Iran
15-08-14	Bae	Jetstream 31	G-GAVA	Linksair	EUR	Doncaster - Robin Hood, United Kingdom
23-08-14	Let	Let 410	9Q-CXB	Doren Air Congo	AFI	3nm east of Kalika, Congo (Democratic Republic)
30-08-14	Antonov	An-12	UR-DWF	Ukraine Air Alliance	CIS	(near) Tagrembait, Algeria
31-08-14	Fokker	F27	5Y-SXP	Safari Express Cargo	AFI	(near) Kogatende, Tanzania
06-09-14	Fokker	F50	5Y-BYE	Jubba Airways	AFI	Mogadishu - Aden Adde Intl, Somalia
21-09-14	Bombardier	Dash 8-300	8Q-IAM	Island Aviation	ASPAC	Maldives
12-10-14	BAE Systems	Jetstream 31	HI816	ACSA - Air Century	LATAM	Punta Cana, Dominican Republic
24-10-14	Boeing	B747-400	B-2433	Great Wall Airlines	NASIA	Shanghai - Pudong, China
25-10-14	Let	Let 410	9Q-COT	Biega Airways	AFI	Shabunda, DR Congo
29-10-14	Shorts	Shorts 360	N380MQ	SkyWay Enterprises	NAM	St Maarten - Princess Juliana Intl, Neth. Antilles
06-11-14	Boeing	B737-800	VT-SGK	Spicejet	ASPAC	Surat, India
06-11-14	Bombardier	DHC-8	C-GGBF	Jazz	NAM	Edmonton
07-11-14	Boeing	B737-400	YA-PIE	Ariana Afghan Airlines	MENA	Kabul, Afghanistan
14-11-14	BAE Systems	BAE 748	5Y-BVQ	Global Air Connection	AFI	Panyagor, South Sudan
18-11-14	Airbus	A320	9M-AJN	AirAsia	ASPAC	Kuala Lumpur - International, Malaysia
24-11-14	Boeing	B747-8	LX-VCC	Cargolux	EUR	Libreville - Leon M'ba, Gabon
19-12-14	Bombardier	Dash 8-300	C6-BFJ	Bahamasair	LATAM	Lyndon Pindling Intl, Nassau
28-12-14	Airbus	A320	PK-AXC	Indonesia AirAsia	ASPAC	Java Sea,off Pulau Belitung,Indonesia
28-12-14	Antonov	An-26	4L-AFS	Air Sirin	CIS	En Route
29-12-14	ATR	ATR 72	5N-BPG	Overland Airways	MENA	Ilorin, Nigeria
30-12-14	Boeing	B737-400	AP-BJN	Shaheen Air International	ASPAC	Lahore, Pakistan

PHASE	SERVICE	PROPULSION	SEVERITY	SUMMARY
GOA	Passenger	Turboprop	Hull Loss	Impacted ground following a go-around
CRZ	Passenger	Jet	Hull Loss	Speed decayed en route leading to loss of control
LND	Cargo	Turboprop	Substantial Damage	Nose gear failed to extend
TOF	Passenger	Turboprop	Substantial Damage	Bird strike - Rejected takeoff
TOF	Passenger	Turboprop	Hull Loss	Aircraft impacted ground shortly after takeoff
LND	Passenger	Turboprop	Substantial Damage	Left main-gear collapse during landing
CRZ	Cargo	Turboprop	Hull Loss	Aircraft disappeared and was found crashed
ICL	Cargo	Turboprop	Hull Loss	Impacted mountains after takeoff
CRZ	Cargo	Turboprop	Hull Loss	Impacted terrain
LND	Passenger	Turboprop	Hull Loss	Runway veer-off and right main gear collapse
LND	Passenger	Turboprop	Substantial Damage	Hard landing on nose gear
LND	Passenger	Turboprop	Hull Loss	Veered off runway
LND	Cargo	Jet	Substantial Damage	Partial gear-up landing
APR	Cargo	Turboprop	Hull Loss	Landed short of runway
ICL	Cargo	Turboprop	Hull Loss	Lost height then impacted water during initial climb
TOF	Passenger	Jet	Substantial Damage	Buffalo strike during takeoff
LND	Passenger	Turboprop	Substantial Damage	Landing gear collapse during landing
LND	Passenger	Jet	Substantial Damage	Main undercarriage collapse during landing
LND	Cargo	Turboprop	Hull Loss	Runway undershoot
LND	Passenger	Jet	Substantial Damage	Tailstrike during landing
LND	Cargo	Jet	Substantial Damage	Hard landing
ESD	Passenger	Turboprop	Substantial Damage	RH main gear collapse at gate
CRZ	Passenger	Jet	Hull Loss	Impacted water
ICL	Cargo	Turboprop	Hull Loss	Aircraft impacted ground after takeoff
LND	Passenger	Turboprop	Substantial Damage	Veered off of runway during landing
LND	Passenger	Jet	Substantial Damage	Bird strike caused damage to landing gear, leading to runway excursion

Annex 4

2014 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	2010	2011	2012	2013	2014
Aerospatiale	262	1,340	1,340	1,340	1,340	1,340
Airbus	A300	255,697	234,284	217,879	185,193	170,750
Airbus	A310	83,142	82,740	76,276	59,248	55,565
Airbus	A318	104,770	97,494	102,386	92,073	94,748
Airbus	A319	2,078,218	2,165,775	2,194,241	2,232,305	2,279,147
Airbus	A320	3,675,582	4,198,008	4,682,066	5,210,942	5,738,565
Airbus	A321	876,919	965,639	1,043,178	1,167,081	1,348,420
Airbus	A330	601,595	691,920	759,229	831,356	923,282
Airbus	A340	201,748	202,660	192,307	175,299	161,876
Airbus	A350	-	-	-	-	55
Airbus	A380	16,906	28,086	42,020	56,607	73,614
Aircraft Industries (LET)	410	117,359	101,253	93,028	91,171	96,333
Antonov	An-12	12,519	10,914	9,646	8,950	7,586
Antonov	An-24	75,983	72,338	56,375	50,785	47,960
Antonov	An-26	27,465	23,823	22,584	20,658	19,842
Antonov	An-28	8,284	5,254	4,565	4,717	4,657
Antonov	An-30	1,127	586	300	381	477
Antonov	An-32	4,033	3,096	2,889	2,969	3,025
Antonov	An-38	3,615	4,259	4,275	4,260	4,260
Antonov	An-72/An-74	720	218	260	355	481
Antonov	An-124	5,672	5,670	5,906	6,187	6,250
Antonov	An-140	2,018	2,974	3,512	3,786	3,421
Antonov	An-148	7,888	12,843	13,518	22,338	22,912
Antonov	An-158	-	-	-	2,000	6,220
Antonov	An-225	48	48	48	47	30
ATR	ATR 42	437,411	440,388	391,738	345,821	368,398

MANUFACTURER	MODEL	2010	2011	2012	2013	2014
ATR	ATR 72	834,525	938,623	968,979	993,768	1,178,886
Avro	RJ	199,128	182,411	144,758	138,644	156,240
BAE Systems	ATP	29,867	26,424	23,839	27,208	29,745
BAE Systems	Jetstream	167,065	162,741	152,793	161,393	158,262
BAE Systems	Jetstream 41	80,918	90,420	92,552	87,581	87,963
BAE Systems	146	75,146	64,343	59,765	55,584	54,888
BAE Systems (BAC)	One-Eleven	385	-	-	-	-
BAE Systems (Hawker Siddeley)	748	19,133	15,754	14,459	13,709	12,980
Boeing	707	1,218	237	252	68	-
Boeing	717	286,787	267,888	280,684	272,971	268,975
Boeing	727	140,719	119,509	98,581	61,795	45,572
Boeing	737	7,950,737	8,375,305	8,643,602	8,760,999	9,375,395
Boeing	747	442,937	418,066	408,753	381,715	355,207
Boeing	757	851,628	856,074	785,044	727,887	765,226
Boeing	767	717,670	719,498	735,067	721,153	754,404
Boeing	777	681,299	722,339	784,617	863,823	938,932
Boeing	787	-	287	10,613	33,464	101,171
Boeing (Douglas)	DC-3	1,594	1,742	1,849	2,021	2,424
Boeing (Douglas)	DC-8	15,075	12,655	5,906	2,545	478
Boeing (Douglas)	DC-9	143,883	99,621	81,464	72,082	34,378
Boeing (Douglas)	DC-10	66,916	62,532	56,228	49,279	45,703
Boeing (Douglas)	MD-11	118,950	116,363	112,599	104,830	98,586
Boeing (Douglas)	MD-80	856,591	808,481	720,334	678,861	662,659
Boeing (Douglas)	MD-90	149,924	106,285	95,364	106,345	104,926
Canadair (Bombardier)	CRJ	2,662,514	2,656,160	2,533,065	2,414,571	2,370,465
CASA / IAe	212	35,955	33,571	30,440	28,818	26,986
CASA / IAe	235	1,637	1,091	2,139	2,172	2,761
Convair	580	35,009	34,478	35,446	34,538	34,629
De Havilland (Bombardier)	DHC-6	711,553	705,442	702,472	696,693	715,802
De Havilland (Bombardier)	DHC-7	58,747	53,115	51,319	48,701	46,193
De Havilland (Bombardier)	DHC-8	1,611,192	1,683,841	1,719,113	1,757,664	1,793,637
Embraer	110 Bandeirante	54,788	41,970	38,219	35,202	33,103
Embraer	120 Brasilia	262,744	249,175	243,276	240,134	266,787
Embraer	135 / 140 / 145	1,445,464	1,444,504	1,449,036	1,425,394	1,304,463
Embraer	170 / 175	575,585	587,855	599,301	645,619	731,509
Embraer	190 / 195	626,813	759,027	938,572	1,063,052	1,141,283
Fairchild (Swearingen)	Metro	691,174	659,096	645,549	632,453	605,227
Fairchild Dornier	328JET	23,807	10,721	14,110	16,738	20,077

MANUFACTURER	MODEL	2010	2011	2012	2013	2014
Fairchild Dornier	228	159,531	159,888	157,919	152,273	154,411
Fairchild Dornier	328	93,744	86,531	69,014	60,623	59,668
Fokker	F27	9,984	7,629	8,077	8,036	6,302
Fokker	F28	15,409	12,812	6,839	2,757	2,616
Fokker	50	169,331	150,868	146,371	125,346	111,950
Fokker	70	72,607	79,271	81,048	70,421	57,865
Fokker	100	301,522	243,798	215,873	195,041	197,080
Gippsland Aeronautics	N22B / N24A Nomad	476	402	294	292	293
Gulfstream Aerospace (Grumman)	Gulfstream	1,971	1,120	894	562	435
Harbin	Y12	9,908	9,991	10,391	10,477	10,066
Hawker Beechcraft	C99	211,016	206,928	204,101	198,644	193,376
Hawker Beechcraft	1900	784,933	827,239	808,803	797,340	792,638
Ilyushin	Il-18	3,251	2,765	2,814	2,679	2,708
Ilyushin	Il-62	6,824	4,195	3,500	3,181	2,493
Ilyushin	Il-76	25,833	23,120	21,892	22,121	22,388
Ilyushin	Il-86	2,127	121	-	-	-
Ilyushin	Il-96	6,179	6,047	6,522	6,458	3,992
Ilyushin	Il-114	793	987	1,112	1,216	1,293
Lockheed Martin	L-182 / L-282 / L-382 (L-100) Hercules	39,132	35,630	32,861	30,738	27,409
Lockheed Martin	L-188	2,213	1,745	1,362	326	1,060
Lockheed Martin	L-1011 Tristar	1,719	1,330	1,446	790	-
NAMC	YS-11	7,301	6,193	4,536	3,509	2,463
Saab	340	432,649	404,565	352,307	337,099	351,063
Saab	2000	49,905	53,295	51,227	50,663	51,449
Shaanxi	Y-8	32	32	16	-	-
Shorts	Skyvan (SC-7)	7,968	9,289	8,570	7,782	7,104
Shorts	330	16,541	15,580	15,609	13,718	12,686
Shorts	360	71,944	69,039	60,966	61,059	59,454
Sukhoi	Superjet 100	-	1,790	7,651	13,004	31,101
Tupolev	Tu-134	37,309	32,407	20,214	18,020	16,928
Tupolev	Tu-154	73,605	46,358	32,891	30,201	23,770
Tupolev	Tu-204 / Tu-214	14,159	14,518	15,327	13,517	13,378
Undefined	Undefined	4,471	3,507	4,167	4,171	4,390
Xian	MA-60	2,867	4,531	4,716	4,148	4,885
Yakovlev	Yak-40	59,219	46,330	37,566	31,910	29,072
Yakovlev	Yak-42 / Yak-142	33,212	27,988	22,078	18,642	18,516

Source: Ascend - A Flightglobal Advisory Service

LIST OF ACRONYMS

ACAS	Airborne Collision Avoidance Systems
ACI	Airports Council International
ACTF	IATA Accident Classification Task Force
ADS-B	Automatic Dependent Surveillance-Broadcast
AES	Arrival/Engine Shutdown (ATA Phase of Flight)
AFI	Africa (IATA Region)
AIP	Aeronautical Information Publication
AMMTE	Aircraft Maintenance Mechanics, Technicians and Engineers
ANSP	Air Navigation Service Provider
AOC	Air Operator's Certificate
APR	Approach (ATA Phase of Flight)
APV	Approaches with Vertical Guidance
ARC	Abnormal Runway Contact
ASBU	Aviation System Block Upgrades
ASPAC	Asia/Pacific (IATA Region)
ATA	Air Transport Association
ATC	Air Traffic Control
ATO	Authorized Training Organizations
AURTA	Aircraft Upset Recovery Training Aid
CA	Captain
CABIN	Cabin Safety Events
CANPA	Continuous Angle Non-Precision Approaches
CANSO	Civil Air Navigation services Organization
CBT	Computer-based Training
CCP	Continuous Climb Operations
CDM	Collaborative Decision Making
CDO	Continuous Descent Operations
CEO	Chief Executive Officer
CFIT	Controlled Flight into Terrain
CICTT	CAST/ICAO Common Taxonomy Team
CIS	Commonwealth of Independent States (IATA Region)
CNS/ATM	Communications, Navigation, Surveillance/Air Traffic Management
COO	Chief Operating Officer
CPL	Commercial Pilot License
CRM	Crew Resource Management
CRZ	Cruise (ATA Phase of Flight)
CSWG	IATA Cabin Safety Working Group
CTOL	Collision with obstacle(s) during takeoff and landing
CVR	Cockpit Voice Recorder
DAQP	De/Anti-Icing Quality Control Pool
DFDR	Digital Flight Data Recorder
DGB	IATA Dangerous Goods Board

LIST OF ACRONYMS (Cont'd)

DGR	Dangerous Goods Regulations
DH	Decision Height
DST	Descent (ATA Phase of Flight)
E-GPWS	Enhanced Ground Proximity Warning System
EASA	European Aviation Safety Agency
EBT	Evidence Based Training
ECL	En Route Climb (ATA Phase of Flight)
EMAS	Engineered Materials Arresting System
ERPTF	IATA Emergency Response Planning Task Force
ESD	Engine Start/Depart (ATA Phase of Flight)
ETOPS	Extended-Range Twin-Engine Operations
EUR	Europe (IATA Region)
FAA	Federal Aviation Administration
FDA	Flight Data Analysis
FDX	Flight Data Exchange
FLC	Flight Close (ATA Phase of Flight)
FLP	Flight Planning (ATA Phase of Flight)
FMS	Flight Management System
FO	First Officer
FOQA	Flight Operations Quality Assurance
FRMS	Fatigue Risk Management system
FSF	Flight Safety Foundation
FSTD	Flight Simulation Training Device
G-COL	Ground Collision
GADM	Global Aviation Data Management
GDDB	Ground Damage Database
GDS	Ground Servicing (ATA Phase of Flight)
GOA	Go-around (ATA Phase of Flight)
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
HL	Hull Loss
HUD	Head Up Display
IAOPA	International Council of Aircraft Owner and Pilot associations
IBAC	International Business Aviation Council
ICAO	International Civil Aviation Organization
ICATEE	International Committee for Aviation Training in Extended Envelopes
ICCAIA	International Coordinating Council of Aerospace Industries Associations
ICL	Initial Climb (ATA Phase of Flight)
IDQP	IATA Drinking-Water Quality Pool
IFALPA	International Federation of Air Line Pilots' Associations
IFATCA	International Federation of Air Traffic Controllers' Associations
IMC	Instrument Meteorological Conditions

IFQP	IATA Fuel Quality Pool
INOP	Inoperative
IOSA	IATA Operational Safety Audit
IQ	Instructor Qualification
IRM	Incident Review Meeting
ISAGO	IATA Safety Audit for Ground Operations
ISSA	IATA Standard Safety assessment
ITDI	IATA Training and Development Institute
ITQI	IATA Training and Qualification Initiative
LATAM	Latin America and the Caribbean (IATA Region)
LND	Landing (ATA Phase of Flight)
LOC-G	Loss of Control - Ground
LOC-I	Loss of Control - In Flight
LOCART	Loss of Control and Recovery Training
LOSA	Line Operations 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)
MPL	Multi-crew Pilot License
MRO	Maintenance Repair Organization
MSTF	IATA Multidivisional Safety Task Force
NAA	National Aviation Authority
NAM	North America (IATA Region)
NASIA	North Asia (IATA Region)
NAVaids	Navigational Aids
NLR/TNO	National aerospace Laboratory/Organization for Applied Scientific Research
NOTAM	Notices to Airmen
NTSB	National Transportation Safety Board
OPC	IATA Operations Committee
PANS	Procedures for Air Navigation
PAT	Pilot Aptitude Testing
PCMCIA	Personal Computer Memory Card International Association
PED	Portable Electronic Device
PF	Pilot Flying
PFD	Primary Flight Display
PFS	IATA Partnership for Safety Program
PM	Pilot Monitoring
PRF	Pre-Flight (ATA Phase of Flight)
PSF	Post-Flight (ATA Phase of Flight)
QAR	Quick Access Recorder
RA	Resolution Advisory

LIST OF ACRONYMS (Cont'd)

RAAS	Runway Awareness and Advisory System
RAeS	Royal Aeronautical Society
RAMP	Ground Handling
RE	Runway Excursion
RERR	IATA Runway Excursion Risk Reduction
RESA	Runway End Safety Area
RI	Runway Incursion
RNAV	Area Navigation
RNP	Required Navigation Performance
RPA	Remotely Piloted Aircraft
RPAS	Remotely Piloted Aircraft Systems
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)
SCF-PP	System/Component Failure or Malfunction (Powerplant)
SD	Substantial Damage
SG	IATA Safety Group
SID	Standard Instrument Departure
SMS	Safety Management System
SOP	Standard Operating Procedures
SPI	Safety Performance Indicator
STAR	Standard Terminal Arrival
STC	Supplementary 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
TIPH	Taxi into Position and Hold
TOF	Takeoff (ATA Phase of Flight)
TURB	Turbulence Encounter
TXI	Taxi-in (ATA Phase of Flight)
TXO	Taxi-out (ATA Phase of Flight)
UAS	Undesired Aircraft State
USOS	Undershoot/Overshoot
WAAS	Wide Area Augmentation System
WGS-84	World Geodetic System 1984

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