Organización de Aviación Civil Internacional
Grupo Regional sobre Seguridad Operacional de la Aviación - Panamérica (RASG-PA)

NOTA DE ESTUDIO

ESC/25 — NE/06
04/12/15

Vigésima Quinta Reunión del Comité Directivo Ejecutivo del Grupo Regional de Seguridad Operacional de la Aviación — Panamérica (RASG-PA ESC/25)
Long Beach, Estados Unidos, 10 al 11 de diciembre de 2015

Cuestión 3 del Orden del Día: **Informes de los Grupos de trabajo de RASG-PA**
3.2 Equipo del Informe Anual de Seguridad Operacional (ASRT)

INFORME ANUAL DE SEGURIDAD OPERACIONAL (ASR) DEL RASG-PA

(Presentada por la Secretaría)

RESUMEN EJECUTIVO

Esta nota de estudio presenta a la Vigésima Quinta Reunión del Comité Directivo Ejecutivo del Grupo Regional de Seguridad Operacional de la Aviación — Panamérica (RASG-PA ESC/25):

- La Quinta Edición del Informe Anual de Seguridad Operacional (ASR);
- Las últimas decisiones del Comité Directivo Ejecutivo (ESC) del RASG-PA con respecto a las próximas ediciones del Informe; y
- El plan de trabajo para la producción de la sexta edición del Informe

Acción:	Se indica en el párrafo 3.1 de esta nota de estudio.
Objetivo Estratégico:	• Seguridad Operacional
Referencias:	• Informe de la Reunión RASG-PA/02 • Informe Anual de Seguridad Operacional del RASG-PA • Informe de la Reunión RASG-PA/04 • Informe de la Reunión RASG-PA/ESC/16 • Plan Global OACI para la Seguridad Operacional de la Aviación (GASP) • Hoja de Ruta para la Seguridad Operacional a Nivel Mundial (GASR) del ISSG

Introducción

1.1 La última edición del Plan Global OACI para la Seguridad Operacional de la Aviación (GASP) contiene las siguientes 4 áreas de seguridad operacional objeto de mejora:

- estandarización
- colaboración
- inversión
- intercambio de información

1.2 Estas 4 áreas deben ser trabajadas primero con un enfoque de vigilancia de la seguridad operacional por un periodo estimado de implementación hasta el año 2017 donde los Estados deberían lograr tener sistemas efectivos de vigilancia de la seguridad operacional hasta alcanzar un nivel de cumplimiento del 60% de las auditorías de la OACI, y donde la Industria y los Estados intercambien información de seguridad operacional. Tanto la Declaración de Bogotá como la Declaración de Puerto España ambas contienen la meta de lograr el 80% en el promedio de cumplimiento de las Regiones SAM y CAR, respectivamente.

1.3 Entre el 2017 y el 2022 todos los Estados deberían tener implementados sus SSPs y los RASG haber incorporado programas de gestión de la seguridad operacional.

1.4 A partir del 2022 hasta el 2027 debería alcanzarse un nivel suficiente para trabajar en modelos predictivos de sistemas de gestión de la seguridad operacional.

1.5 Esta visión ha sido la base del trabajo del RASG-PA desde sus inicios mediante la adopción de un enfoque proactivo y/o predictivo en la evaluación del riesgo para formular estrategias de seguridad operacional en base a información recopilada y analizada de seguridad operacional.

1.6 Desde sus inicios, el RASG-PA concluyó que un informe anual de seguridad operacional (ASR) debería ser desarrollado bajo un ambiente de **colaboración** e **intercambio de información de seguridad operacional**.

1.7 Este informe contendría las siguientes 3 secciones:

- reactiva,
- proactiva y
- predictiva

1.8 Inicialmente, el informe contenía en su mayoría información reactiva y, en la medida en que el intercambio de información fue mejorando y se lograba un mayor nivel de madurez en lo que a gestión de la seguridad concierne, se esperaba poder transitar hacia un ambiente más predictivo. Se esperaba que en un período de cinco años o más se lograría este nivel de madurez. Ahora, que la quinta edición del ASR ha sido distribuida, podemos concluir que se ha logrado alcanzar este nivel de madurez. La quinta edición del informe del ASR contiene una mayor cantidad de inteligencia de seguridad operacional producida a través del procesamiento de datos reactivos, proactivos y predictivos que ayuda a la Región a la identificación, priorización e implementación de medidas de mitigación de riesgos de seguridad operacional en la Región.

1.9 Este producto del RASG-PA ha sido adoptado en otras regiones del mundo que están iniciando sus RASG; de igual forma, la sede de la OACI publica un informe anual global de seguridad operacional.

1.10 Se esperaría también que los Programas de Seguridad Operacional de los Estados (SSP), como parte de sus procesos nacionales de gestión de la seguridad operacional, concuerden con las ventajas de producir un informe nacional de seguridad operacional dividido en secciones que reflejen los procesos de análisis de información reactiva, proactiva y predictiva, como una forma de poder identificar tendencias, ayudar en la toma de decisiones y medir la madurez que va alcanzando el sistema de gestión. De esta forma, transitar desde la toma de decisiones inicial, basada en información reactiva, a un ambiente donde se tomen decisiones con base en una combinación de fuentes de información reactiva, proactiva y predictiva.

2. **Metodología para el desarrollo del ASR basado en el intercambio de información en un ambiente colaborativo**

2.1 El desarrollo del Informe Anual de Seguridad Operacional del RASG-PA requiere una participación activa de los integrantes del equipo, conducente a un análisis conjunto de los datos de seguridad operacional proporcionados por las diferentes fuentes de información, utilizando para su evaluación las métricas específicamente desarrolladas. Igualmente, permitirá establecer una visión compartida para identificar y resaltar las principales áreas de interés, clasificándolas según su origen en reactivas, proactivas o predictivas.

2.2 Del 26 al 28 de mayo de 2015, el equipo que desarrolla el ASR se reunió en la Oficina Regional de la OACI para Sudamérica en Lima para trabajar en el desarrollo de la sexta edición del ASR, que se adjunta como **Apéndice** a esta NE.

2.3 En el desarrollo de esta sexta edición del ASR, se utilizaron datos proporcionados por OACI, Boeing, IATA y también GREPECAS (Grupo Regional CAR/SAM de Planificación y Ejecución) a través del CRPP (Comité de Revisión de Programas y Proyectos) aprobó un texto para el ASR incluyendo los resultado del GTE (Grupo de Trabajo de Escrutinio) mostrando información sobre LHD (gran desviación de altitud). En particular, esta edición muestra un incremento en la data de la sección de información predictiva, concordante con la maduración de los sistemas de captura y análisis de datos de seguridad operacional de la Región Panamericana.

2.4 La sexta edición del ASR muestra que las principales categorías de interés para la Seguridad Operacional en la Región continúan siendo Pérdida de Control en Vuelo (LOC-I), Salida de Pista (RE) e Impacto Contra el Terreno sin Pérdida de Control (CFIT), a las que se agrega Colisión/Cuasicolisión en Vuelo (MAC).

2.5 En la sexta edición del ASR, se siguen resaltando los precursores de información proactiva y predictiva para las categorías de interés, tales como Aproximaciones No Estabilizadas (precursores de RE) o eventos relacionados con EGPWS (precursor de CFIT) o TCAS RA (precursores de MAC).

2.6 Adicionalmente, la sección reactiva mantiene información valiosa sobre estadísticas de accidentes de los últimos diez años. Por su parte la sección proactiva contiene el resultado y análisis del cumplimiento por parte de los Estados de las normas y procedimientos de la OACI producto del Programa USOAP. Asimismo, se incluye una sección con los resultados del Programa IOSA de la IATA.

3. **Acción sugerida**

3.1 Se invita al RASG-PA ESC/25 a:

a) tomar nota sobre la información proporcionada en esta nota de estudio;

b) tomar nota sobre la Sexta Edición del Informe Anual de Seguridad Operacional del RASG-PA que se presenta como Apéndice a esta NE, y comentar sobre la fecha posible de su publicación, e

c) identificar las oportunidades de mejora del ASR para consideración del ASRT.

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ANNUAL SAFETY REPORT

Sixth Edition

INFORME ANUAL DE SEGURIDAD OPERACIONAL – Sexta Edición

Regional Aviation Safety Group – Pan America (RASG-PA)

Grupo Regional de Seguridad Operacional de la Aviación – Pan América (RASG-PA)

Information produced with data from 2005 until 2015

Información producida con datos desde 2005 hasta 2015

Issued in December 2015

Publicado en diciembre de 2015

REGIONAL AVIATION SAFETY GROUP
PAN AMERICA

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Foreword

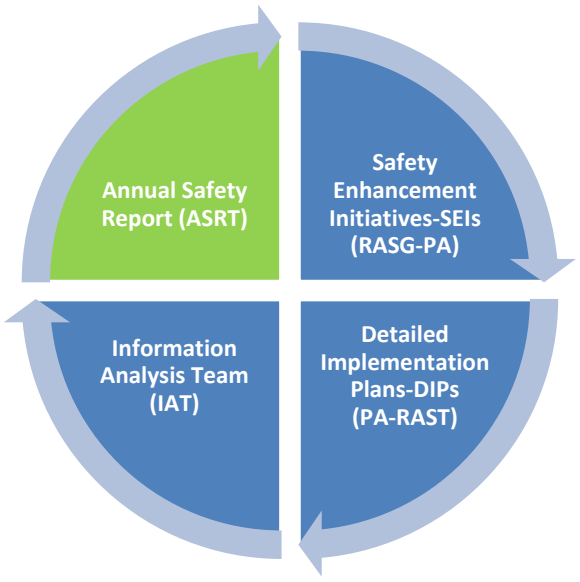
The Regional Aviation Safety Group – Pan America (RASG-PA) was established in November 2008 as the focal point to ensure harmonization and coordination of efforts aimed at reducing aviation safety risks in the Pan American Region.

RASG-PA supports implementation of the ICAO Global Aviation Safety Plan (GASP) and complies with ICAO Council approval of Regional Aviation Safety Groups (RASGs) with the objective to address global aviation safety matters from a regional perspective.

RASG-PA membership includes representatives from all States/Territories of ICAO NAM/CAR and SAM Regions, ICAO, international organizations and industry.

The RASG-PA safety management process, as depicted in Figure 1, consists of four recurrent stages. The Annual Safety Report is not only the first stage, but also a key component, gathering safety data and information in order to produce safety intelligence, showing a consolidated vision of aviation Safety using sources from Regional stakeholders. Further stages of the process use this Safety Intelligence as the foundation for the development of improvement actions.

Figure 1. RASG-PA Safety Management Process



The Annual Safety Report is the first exclusive Safety Report for the Pan American Region and is based on aviation safety data and information kindly provided by Boeing, The CAR/SAM Regional Monitoring Agency (CARSAMMA), IATA, ICAO and The Regional Safety Oversight Cooperation System (SRVSOP) and the analysis is completed through in-kind contributions of experts from RASG-PA members. Other RASG-PA members are encouraged to share their safety data.

Previous editions of the Annual Safety Report and other RASG-PA related documentation can be downloaded at: www.icao.int/rasgpa. For additional information contact: rasg-pa@icao.intRASG-PA is fulfilling the objective of enhancing safety in the Pan American Region by reducing duplication of efforts and expenditure of human and financial resources.

The success of RASG-PA is dependent on the commitment, participation and contributions of all of its members by means of financial and in-kind support.

Introduction

The foremost objective of the Regional Aviation Safety Group – Pan America (RASG-PA) Annual Safety Report (ASR) is **to gather aviation safety data and information** from different stakeholders **to identify the main aviation safety concerns** in the Pan American Region.

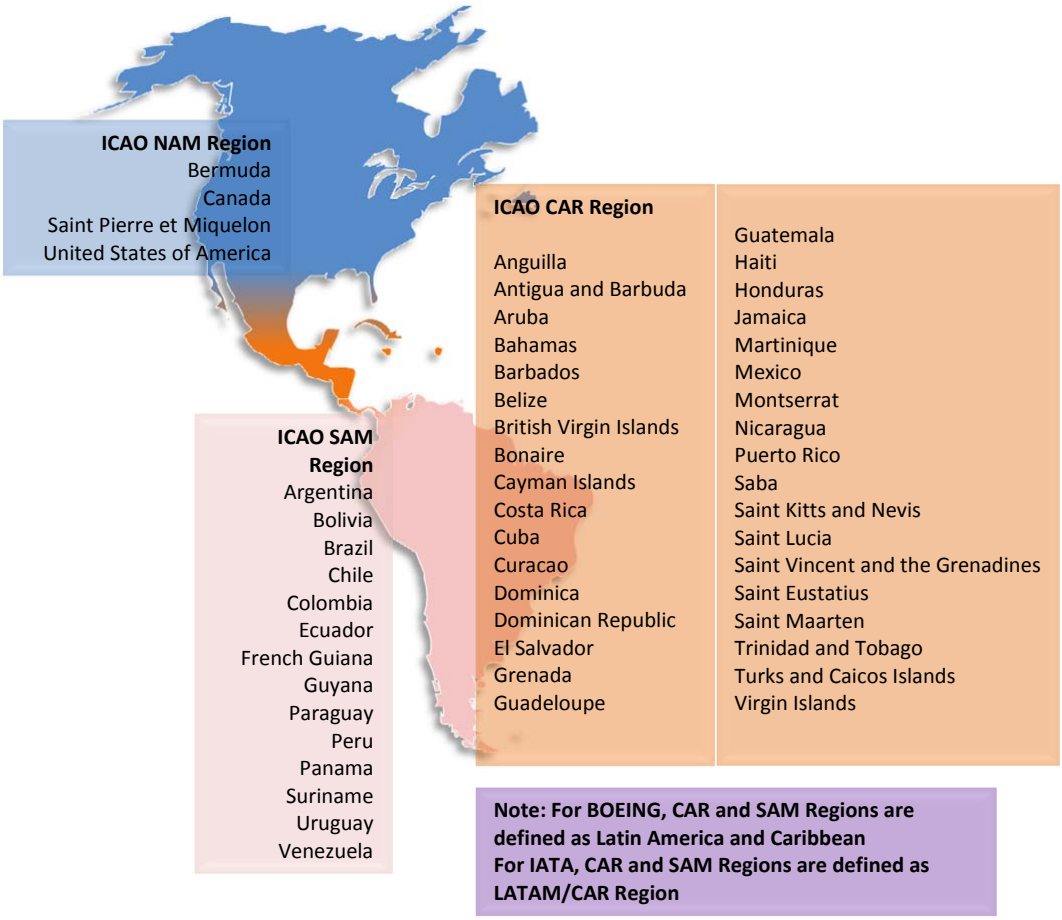
The ASR contains three sections:

1. **Reactive** Information: presents safety analysis based upon past occurrences (accidents and incidents) in the Pan American Region.
2. **Proactive** Information: includes analysis of States' existing conditions (ICAO Standards and Recommended Practices implementation, traffic) and service providers (IATA Operational Safety Audits).
3. **Predictive** Information: based upon analysis of Flight Operations Quality Assurance (FOQA) de-identified data, oriented towards identifying future hazards for initiating corresponding risk mitigation actions.

Information in this report mainly refers to the latest 10-year period. Some sections could include data from different time periods to be more representative of the actual Safety status of the Region.

The first versions of this report had Reactive Information representing the largest portion of the report. However, as the Region matures in processing and exchanging proactive and predictive information, the report is reaching a balance on the contents of each section, refining the quality of the safety intelligence produced for facilitating the decision making process and for the benefit of aviation safety.

Figure 2. The Pan American Region (RASG-PA Region)



Executive Summary

The RASG-PA Annual Safety Report – Sixth Edition presents the analysis of aviation safety data and information of the Pan American Region conducted by the RASG-PA Annual Safety Report Team (ASRT).

The results of the analysis showed that the top categories to focus safety enhancement initiatives are related to:

- Loss of Control In-flight (LOC-I)
- Runway Excursion (RE)
- Controlled Flight Into Terrain (CFIT)
- Mid-Air Collision (MAC)

According to the statistics in this report, the number of fatal accidents in 2014 in the Pan American Region for scheduled commercial air transport operations involving aircraft with maximum take-off mass (MTOM) above 5,700 kilograms was lower than the previous year and accident rates remained below world average.

Notably, The four accident categories of interest (LOC-I, RE, CFIT and MAC) showed decreasing trends through the latest ten year period (2005-2014), not only while looking at the reactive data, but also according to the behaviour of their precursors, as described in the predictive safety information section of this report.

With regard to the ICAO Universal Safety Oversight Audit Programme (USOAP), the analysis contained in the proactive safety information section continues to show technical staff qualification and training as the critical element with the lowest level of implementation in the Pan American Region, and the analysis by area indicates the necessity to improve Air Navigation Services (ANS), Aerodromes and Ground Aids (AGA) and Accident and Incident Investigation (AIG) areas in the CAR and SAM Regions due to the growth of Commercial Air Transport Operations.

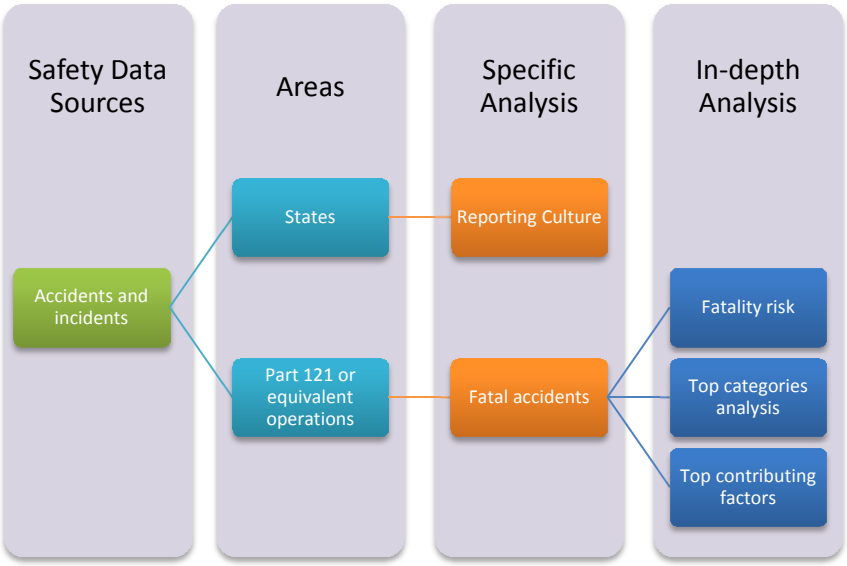
IOSA results revealed determined operational policies and flight procedures that could be related to the top risk categories (LOC-I, CFIT and RE). This, coupled with the findings of USOAP/CMA, indicates that this area not only involves States but also service providers.

1 Reactive Safety Information

This section will assist with comprehending the behaviour of the Pan American Region with regard to Safety, based upon the analysis of reactive safety data (accidents and incidents).

The process followed by the RASG-PA Annual Safety Report Team (ASRT) for analysing reactive information consists of retrieving safety data from Boeing, IATA and ICAO, and using an approach **from a general perspective to specific areas**, highlighting the safety concerns at different levels, which is depicted in Figure 3.

Figure 3. Reactive Safety Data Analysis

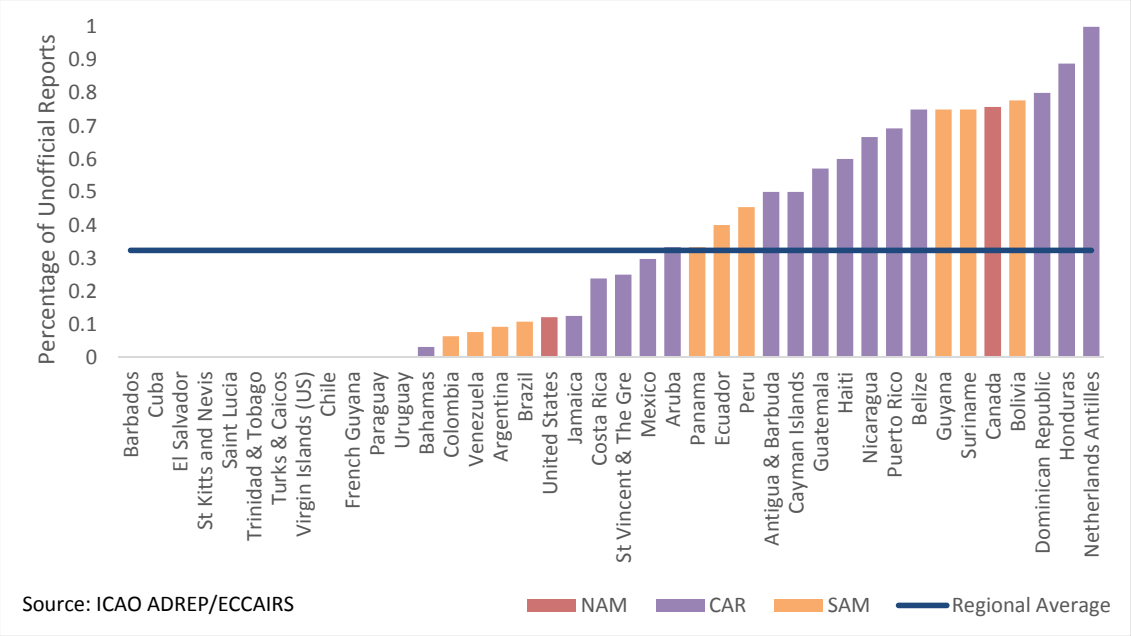


At the time of analysis, there were 4841 occurrences[1] reports (accidents, serious incidents and incidents) belonging to the Pan American Region recorded in the ICAO ADREP/ECCAIRS database[2] for the period 2005-2014, distributed as follows: 3090 for the NAM Region, 668 for the CAR Region and 1083 for the SAM Region.

The following information provides a metric for the **reporting culture in the Pan American Region based on compliance with Annex 13 to the Convention on International Civil Aviation**. The ICAO ADREP/ECCAIRS database was queried to retrieve official and unofficial reports. Official reports are based on data provided by the States in compliance with Annex 13. Alternatively, unofficial reports include occurrences not reported to ICAO by the competent authority, but where there is sufficient information to code them. Figure 4 illustrates the percentage of unofficial reports per State, irrespective of the number of occurrences.

[1] Occurrence: An event leading to undesired/unexpected consequences. ADREP/ECCAIRS Taxonomy classifies occurrences in relation to severity (accident, serious incident, etc.) and the specific category (runway excursion, loss of control in-flight, etc.)
[2] The ICAO ADREP/ECCAIRS data used in this report was consulted on May 22th, 2015.

Figure 4. Percentage of unofficial Reports per State by ICAO Region, 2005-2014 (ICAO ADREP/ECCAIRS)



Analysis of the data shows that the regional average of unofficial reports for the period 2005 – 2014 was 32.3%, while previous year moving averages were 18.9% (2004-2013), 35.5% (2003-2012) and 36.06% (2002-2011). The main variation in the average of unofficial reports compared to the previous ten year moving average, was due to one of the States showed a highly increased number of open occurrences. Nevertheless, the reporting culture based on compliance with Annex 13 as shown in the Figure 4 appears to be improving in the Region.

1.1 Fatal Accidents during Commercial Air Transport Operations

According to the ICAO ADREP/ECCAIRS and iSTARS accidents (as defined by the Annex 13 to the Convention on International Civil Aviation) in the Pan American Region involving aircraft with Maximum Take-off Mass (MTOM) **above 5,700 kilograms during scheduled commercial air transport operations**, during the time period between 2005 and 2014 reached 393 in total. 8% of these accidents resulted in fatalities.

The distribution of global accidents, fatal accidents and fatalities by RASG (Regional Aviation Safety Group) is shown in table 1. Also, table 2 shows the specific numbers for the Pan American Region.

Table 1. Accident Statistics and Accident Rates - 2014 (ICAO Safety Report 2015)

RASG	Estimated Departures (in millions)	Number of accidents	Accident rate (per million departures)	Fatal accidents	Fatalities	Share of Traffic	Share of Accidents
AFI	0.7	6	8.6	1	118	2%	6%
APAC	10.2	18	1.8	3	449	31%	18%
EUR	8.9	26	2.9	1	298	27%	27%
MID	4.0	7	2.3	2	39	9%	7%
PA	9.9	41	4.1	0	0	30%	42%
WORLD	33.0	98	3.0	7	904	100%	100%
This table refers to Scheduled Commercial Air Transport Accidents – Aircraft MTOM above 5,700 kilograms							

Table 2. Pan America Scheduled Commercial Air Transport Accidents (ICAO Safety Report 2015, iSTARS and ADREP/ECCAIRS)

PAN AMERICA Scheduled Commercial Air Transport[3] Accidents[4]			
Year	**Total Accidents**	**Fatal accidents[5]**	**Total fatalities**
2004-2013 avg.	39.3	3.3	81.8
2013	36	4	18
2014	41	0	0
This table refers to Scheduled Commercial Air Transport Accidents – Aircraft MTOM above 5,700 kilograms			

It is important to note that even with a higher number of accidents compared to previous years, the Pan American Region did not show fatal accidents in 2014.

1.1.1 Main Findings

1.1.1.1 Contributing Factors to 2010-2014 Accidents in NAM and LATAM/CAR Regions (IATA)

This section presents in-depth analysis of the **2010-2014 IATA recorded accidents** for the NAM and LATAM/CAR Regions to identify common issues that can be shared by operators and States to develop suitable prevention/mitigation strategies. These findings were categorized using an IATA developed accident classification system based on the **Threat and Error Management** (TEM) framework.

The IATA accident analysis includes fixed-wing aircraft over 5,700 kg with jet or turboprop propulsion engaged in commercial operations. The accident definition is based on the Annex 13 to the Convention on International Civil Aviation, and includes a metric for the severity of the damage. Injury only accidents are not included in the IATA analysis.

Table 3. Top Contributing Factors[6] for NAM Region Accidents, 2010-2014 (IATA)

Latent conditions	11% Regulatory oversight 9% Technology and equipment 8% Maintenance Ops: SOPs and checking 8% Design 6% Flight operations: training systems	
Threats	**Environmental**	18% Meteorology: Wind/wind shear/gusty wind (75%), Poor visibility/IMC (50%) 11% Lack of visual reference 9% Air traffic services
	Airline	31% Aircraft malfunction: Gear/tire (60%), fire/smoke (cockpit/cabin/cargo) (15%) 11% Ground events 8% Maintenance events
Flight Crew Errors	14% Manual handling/flight controls 8% SOP adherence/SOP cross-verification: Intentional non-compliance (60%), unintentional non-compliance (40%)	
Undesired Aircraft States	12% Long/floated/bounced/firm/off-center/crabbed land 9% Vertical/lateral/speed deviation	

3 Scheduled Commercial Air Transport Operation: an air service open to use by the general public and operated according to a published timetable or with such a regular frequency that it constitutes an easily recognizable systematic series of flights, which are open to direct booking by members of the public, according to ICAO DOC 9626.

4 ICAO ADREP/ECCAIRS provided data from 2004 to 2007. Data from 2008 to 2013 was extracted from ICAO iSTARS, and 2014 is referred to ICAO Safety Report 2015.

5 Fatal accident: an accident where at least one passenger or crewmember is killed or later dies (within 30 days following the accident date).

6 Latent Conditions: conditions present in the system before the accident and triggered by various possible factors.
Threats: 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.
Flight Crew Errors: an observed flight crew deviation from organizational expectations or crew intentions.
Undesired Aircraft States: 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.

	6% Controlled flight toward terrain 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

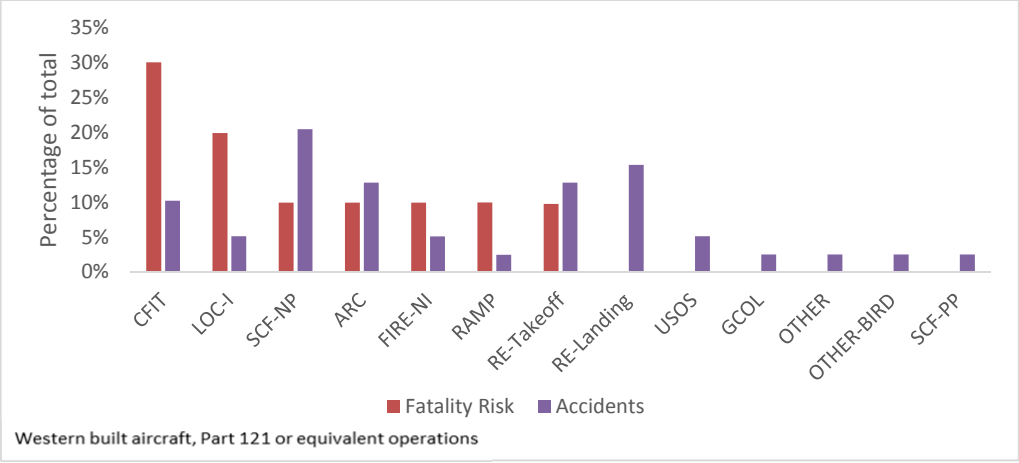
Table 4. Top Contributing Factors for LATAM/CAR Region Accidents, 2010-2014 (IATA)

Latent conditions	22% Safety management 20% Regulatory oversight 12% Flight operations: SOPs and checking 12% Flight operations: training systems 12% Maintenance operations: SOPs and checking	
Threats	**Environmental**	22% Ground-based nav aid malfunction or not available 20% Meteorology: Wind/wind shear/gusty wind (38%), Icing conditions (25%), thunderstorms (25%)
	Airline	40% Aircraft malfunction: Gear/tire (56%), brakes (12%) 11% Maintenance events Manuals/charts/checklists (2%)
Flight Crew Errors	20% Manual handling/flight controls 18% SOP adherence/SOP cross-verification: Intentional non-compliance (43%), unintentional non-compliance (43%)	
Undesired Aircraft States	18% Vertical/lateral/speed deviation 18% Long/floated/bounced/firm/off-center/crabbed land 12% Unstable approach 10% Continued landing after unstable approach 5% Landing gear	
Countermeasures	25% Overall crew performance 18% Monitor/cross-check 12% Leadership 8% Captain should show leadership	
Additional Classifications	17% Insufficient data for contributing factors	

1.1.1.2 Most Frequent Accident Categories

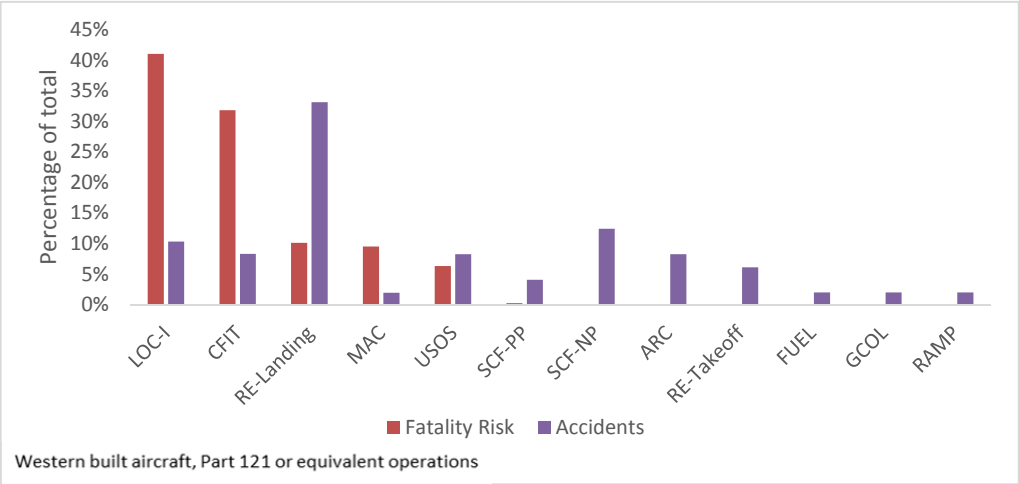
Data from 2005 to 2014 analyzed by Boeing consisted in accidents resulting in hull losses and/or onboard fatalities involving western built aircraft during part 121 or equivalent operations (greater than 9 seats or greater than 7,500 pounds of cargo capacity), classified by the State of Operator, and revealed CFIT, LOC-I and RE (Takeoff and Landing) as the top categories of interest in **North America**. The results of this analysis are depicted in Figure 5.

Figure 5. North America portion of fatality risk by accident type, 2005-2014 (Boeing)



In **Latin America and the Caribbean**, Boeing determined LOC-I, RE, CFIT and MAC as the top fatality risk categories, as presented in the Figure 6.

Figure 6. Latin America & Caribbean portion of fatality risk by accident category. 2005-2014 (Boeing)



1.1.1.3 In-depth Analysis of Runway Excursion Data

According to Boeing, the distribution of this type of occurrence from 2004 to 2013, divided by **operator domicile** in the Pan American Region, showed the following trends:

Figure 7. Runway Excursion: Operator Domicile: North America, 2005-2014 (Boeing)

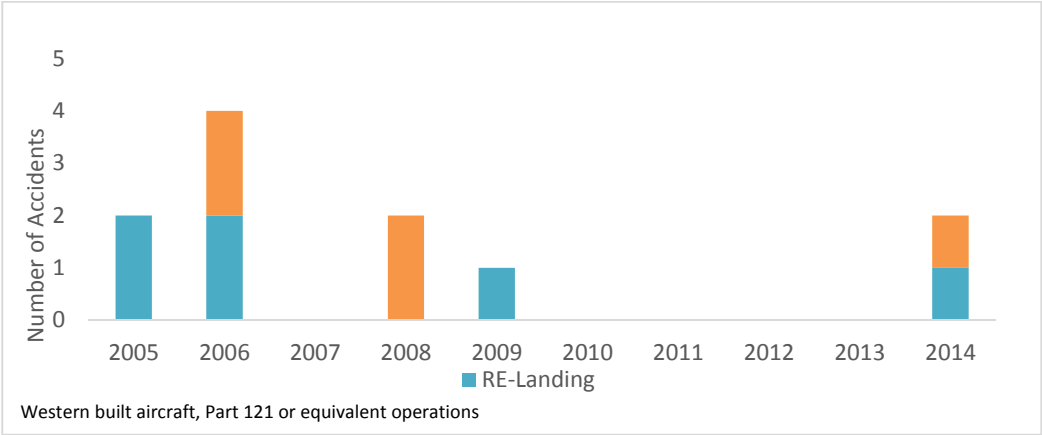
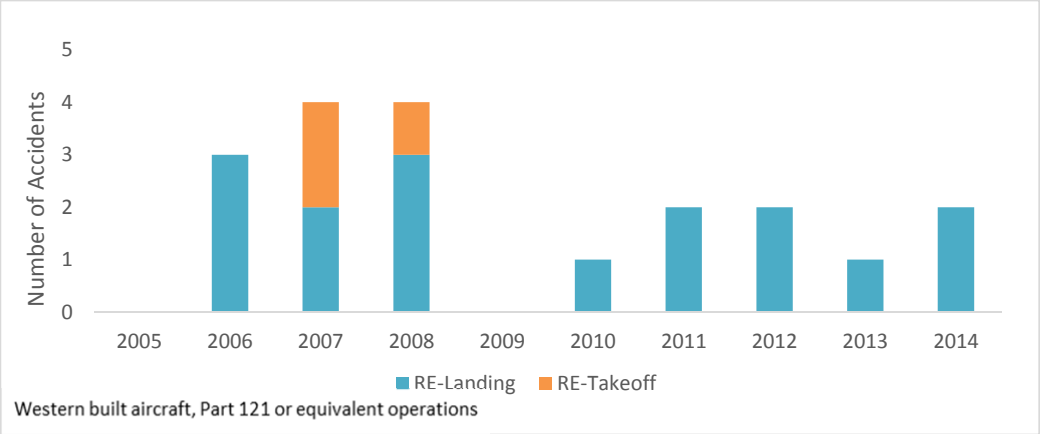


Figure 8. Runway Excursion: Operator Domicile: Latin America & Caribbean, 2005-2014 (Boeing)



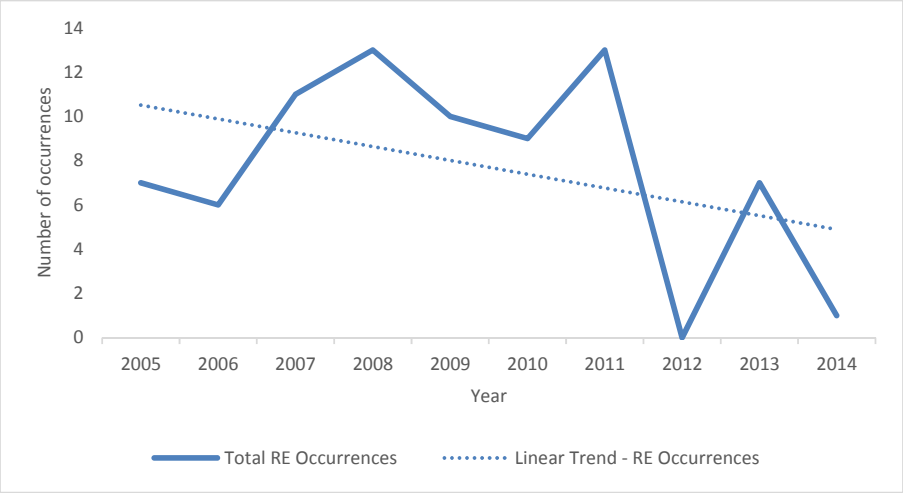
IATA determined the Top Contributing Factors regarding runway excursion accidents occurred worldwide as shown in the following table.

Table 5. Top Contributing Factors for Global Runway Excursion Accidents, 2010-2014 (IATA)

Latent conditions	38% Regulatory oversight 27% Safety management 16% Flight operations: Training systems 9% Flight operations: SOPs and checking 4% Maintenance operations: SOPs and checking	
Threats	**Environmental**	43% Meteorology: Wind/wind shear/gusty wind (50%), poor visibility/IMC (38%), thunderstorms (34%) 41% Airport facilities 16% Ground-based nav aid malfunction or not available
	Airline	20% Aircraft malfunction: Brakes (27%), contained engine failure/powerplant malfunction (27%) 4% Maintenance events
Flight Crew Errors	38% Manual handling/flight controls 28% SOP adherence/SOP cross-verification: Intentional non-compliance (71%), Unintentional non-compliance (24%) 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% Unstable approach 16% Vertical/lateral/speed deviation	
Countermeasures	32% Overall crew performance 24% Monitor/cross-check 14% Contingency management 14% Taxiway/runway management	
Additional Classifications	18% Insufficient data for contributing factors	

ICAO data shows that despite the number of fatal accidents categorized as RE occurred during the time period, total regional occurrence data, including all records of accidents and incident involving aircraft with MTOM above 5,700 kilograms during scheduled commercial air transport operations, showed 77 runway excursions (an average of 7.7 per year) in the last 10-year moving period (2005-2014) and a decreasing trend. The most frequent categories associated to RE were Abnormal Runway Contact (ARC) (14% of REs), Loss of Control – Ground (LOC-G) (13% of REs) and System/Component Failure or Malfunction non-powerplant (SCF-NP) (12% of REs). The number of REs per year are depicted in the following figure.

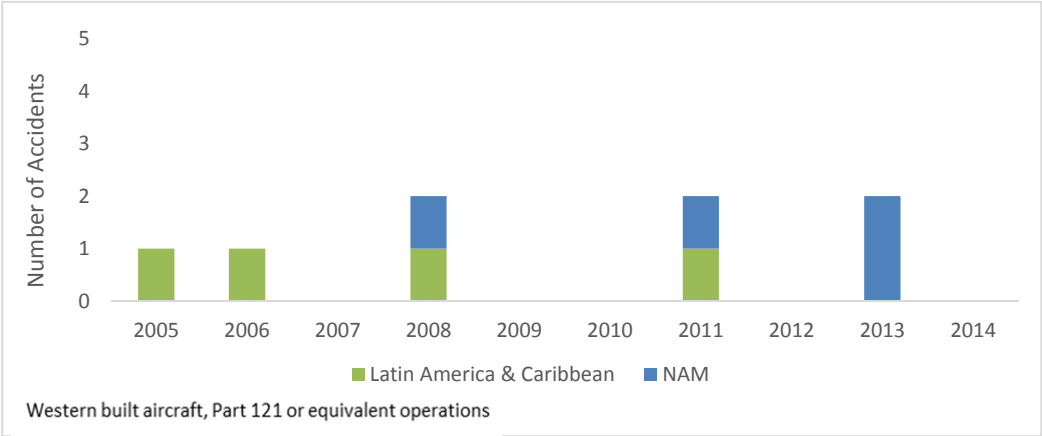
Figure 9. RE Total Occurrences Distribution per Year – Pan America



1.1.1.4 In-depth Analysis of Controlled Flight Into Terrain Data

According to Boeing, CFIT accidents since 1987 in the Pan American Region by operator domicile show the variations as depicted in Figure 10.

Figure 10. CFIT Accidents per Operator Domicile, 2005-2014



In accordance with IATA, the main latent conditions for CFIT Accidents are related to poor regulatory oversight or Technology and equipment. These and other facts are depicted in the following table.

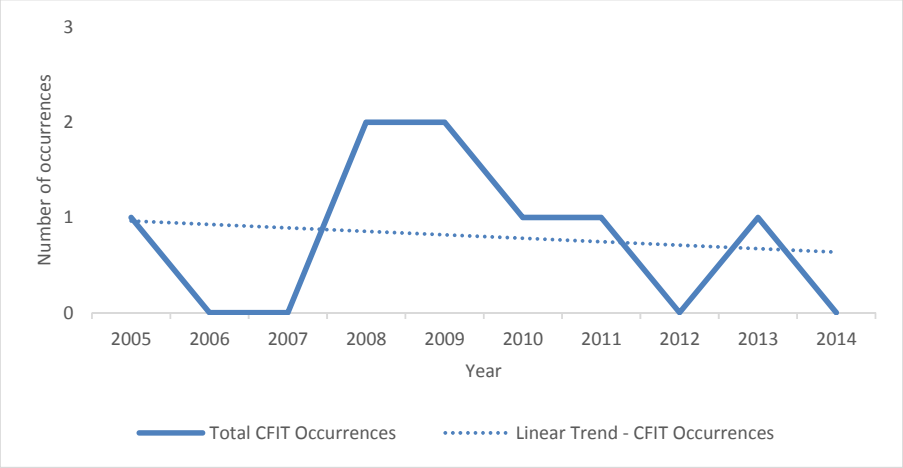
Table 6. Top Contributing Factors for Global CFIT Accidents, 2010-2014 (IATA)

Latent conditions	79% Regulatory oversight 59% Technology and equipment 41% Safety management 19% Flight operations: Training systems 15% Flight operations: SOPs & checking	
Threats	**Environmental**	56% Meteorology: Poor visibility/IMC (87%), wind/windshear/gusty wind (13%), thunderstorms (13%) 52% Ground-based nav aid malfunction or not available 22% Terrain/obstacles
	Airline	4% Maintenance events 4% Aircraft malfunction: Avionics/Flight instruments (100%), autopilot/FMS (100%) 4% Operational pressure

Flight Crew Errors	48% SOP adherence/SOP cross-verification: Intentional non-compliance (69%), unintentional non-compliance (31%) 19% Manual handling/flight controls 19% Callouts
Undesired Aircraft States	52% Vertical, lateral or speed deviations 52% Controlled flight towards terrain 15% Unnecessary weather penetration 7% Unstable approach 4% Continued landing after unstable approach
Countermeasures	48% Monitor/cross-check 44% Overall crew performance 15% Comunication environment
Additional Classifications	21% Insufficient data for contributing factors

According to ICAO ADREP/ECCAIRS, CFIT showed an average of 0.8 total occurrences (accidents and incidents) in the Pan American Region within the latest 10 year moving average (2005-2014), with a decreasing trend, as shown in the following graph.

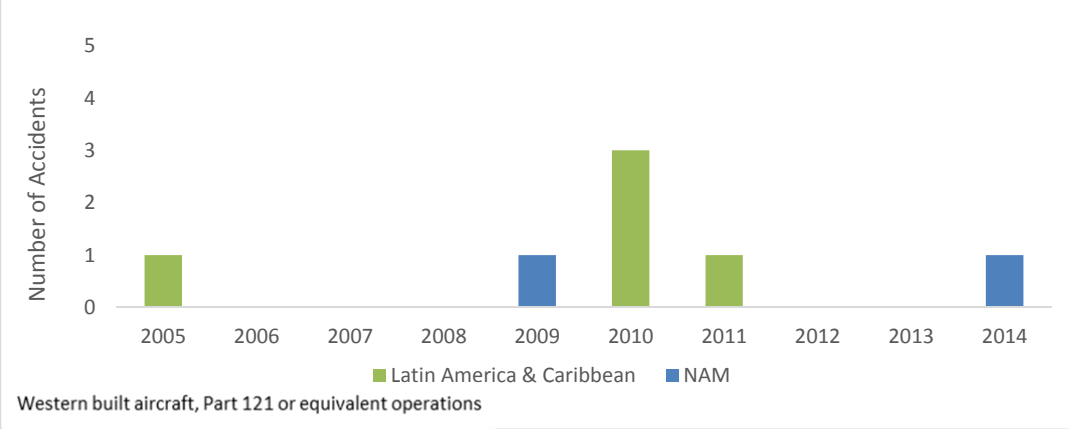
Figure 11. CFIT Total Occurrences Distribution per Year – Pan America



1.1.1.5 In-depth Analysis of Loss of Control In-flight Data

Boeing shows the variation of this category in accidents by operator domicile in the Pan American Region in Figure 12.

Figure 12. LOC-I Accidents per Operator Domicile, 2005-2014 (Boeing)



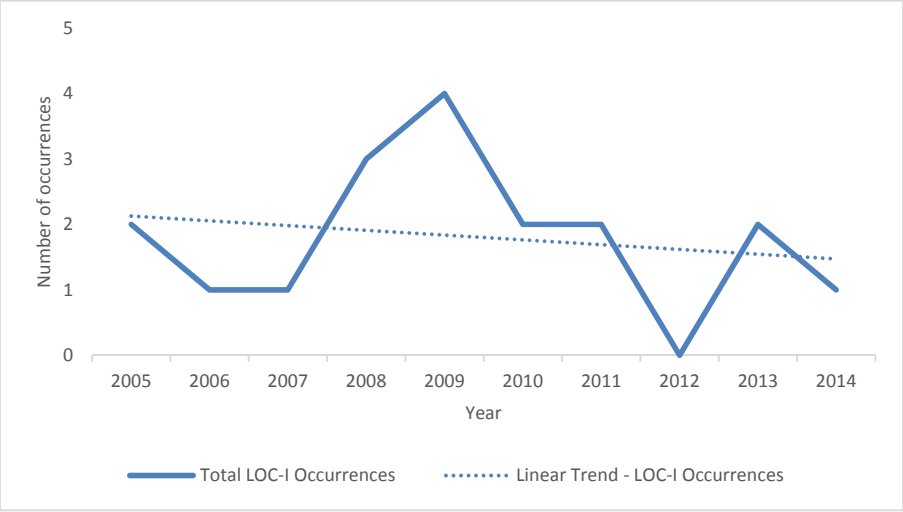
IATA Top Contributing Factors for LOC-I Accidents are shown in the following table.

Table 7. Top Contributing Factors for Global LOC-I Accidents, 2010-2014 (IATA)

Latent conditions	27% Safety management 21% Flight operations: Training systems 21% Regulatory oversight 15% Flight operations: SOPs and checking 12% Selection systems	
Threats	**Environmental**	42% Meteorology: Icing conditions (36%), poor visibility/IMC (36%), thunderstorms (36%) 12% Lack of visual reference 9% Ground-based nav aid malfunction or not available
	Airline	42% Aircraft malfunction: Contained engine failure/ powerplant malfunction (64%), Fire/smoke (Cockpit/cabin/cargo) (14%) 9% Operational pressure 9% Maintenance events
Flight Crew Errors	33% Manual handling/flight controls 30% SOP adherence/SOP cross-verification: Intentional non-compliance (60%), unintentional non-compliance (40%) 9% Callouts	
Undesired Aircraft States	24% Vertical/lateral speed deviation 18% Operation outside of aircraft limitations 18% Unnecesary weather penetration 12% Unstable approach 6% Abrupt aircraft control	
Countermeasures	36% Overall crew performance 18% Contingency management 12% Captain should show leadership 12% Leadership	
Additional Classifications	13% Insufficient data for contributing factors	

ICAO data shows that LOC-I total occurrences showed an average of 1.8 per year, with a decreasing trend in the period 2005-2014. 28% of these occurrences was associated to powerplant or system failure/malfunction (SCF-PP or SCF-NP categories) and in 11% there was found an association to Icing (ICE) category. Detailed distribution of LOC-I occurrences is shown in the following figure.

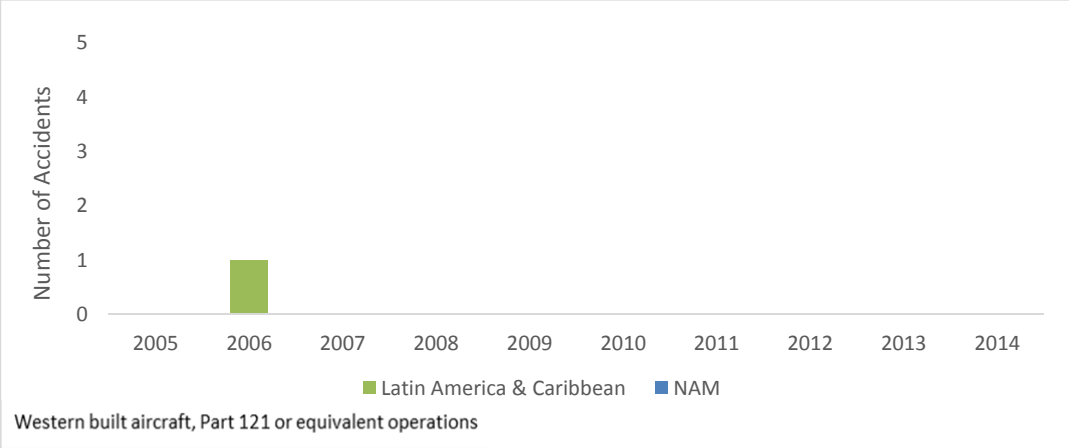
Figure 13. LOC-I Total Occurrences Distribution per Year – Pan America (ICAO ADREP/ECCAIRS)



1.1.1.6 In-depth Analysis of Mid Air Collision Data

According to Boeing, MAC categorized accidents varied during the time period from 2005 to 2014 as shown in Figure 14.

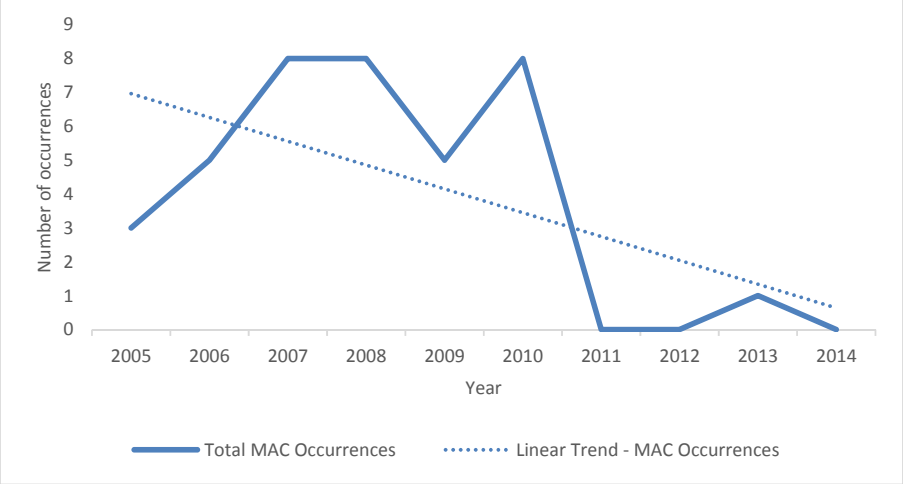
Figure 14. MAC Accidents per Operator Domicile, 2005-2014 (Boeing)



IATA recorded one accident in the latest five year period (2010-2014), but no contributing factors nor relationships of interest were published.

ICAO data shows 38 total MAC occurrences in the time period from 2005 to 2014, in the Pan American Region, with a decreasing trend in the last four years of the period, as presented in Figure 15. In 26% of these occurrences, it was found an association to Air Traffic Management category (ATM) and in 8% was found a correlation to Abrupt Manoeuvring (AMAN) category.

Figure 15. MAC Total Occurrences Distribution per Year – Pan America (ICAO ADREP/ECCAIRS)



1.1.2 IATA Operational Safety Audit (IOSA) Summary

IOSA is a global program built on ICAO standards and industry best practices.

The analysis performed by IATA, comparing the number of recorded accidents per million sectors[7] flown for IOSA registered airlines versus non-IOSA registered airlines, indicates lower rates for IOSA operators in both NAM and LATAM/CAR Regions as shown in the following figures.

Figure 16. NAM Accidents per million sectors flown, 2010-2014 (IATA)

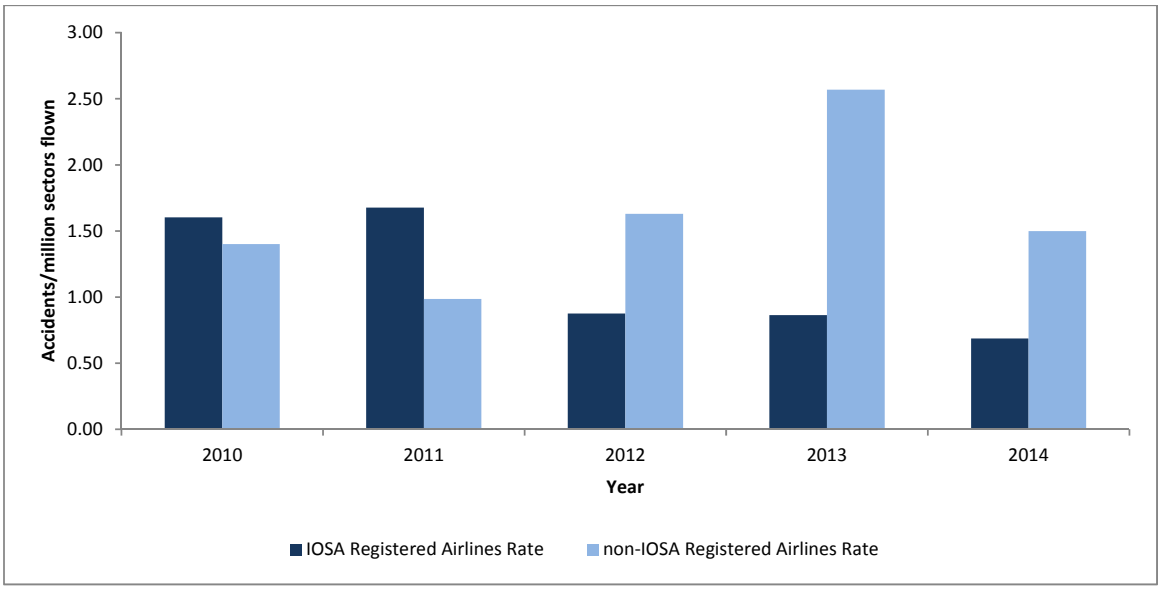
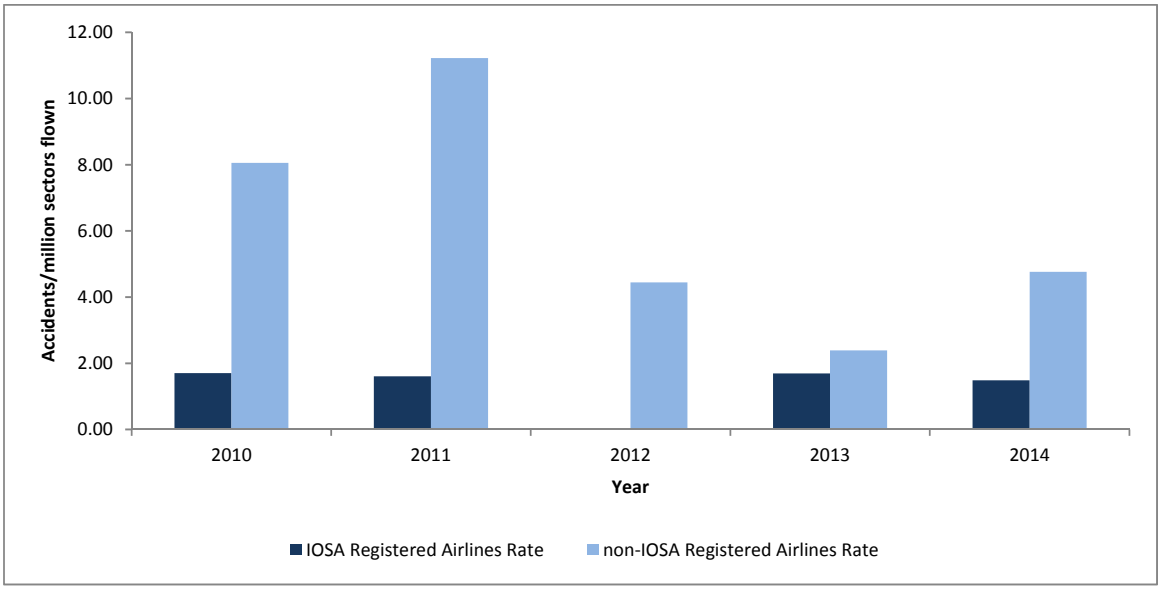


Figure 17. LATAM/CAR Accidents per million sectors flown, 2010-2014 (IATA)

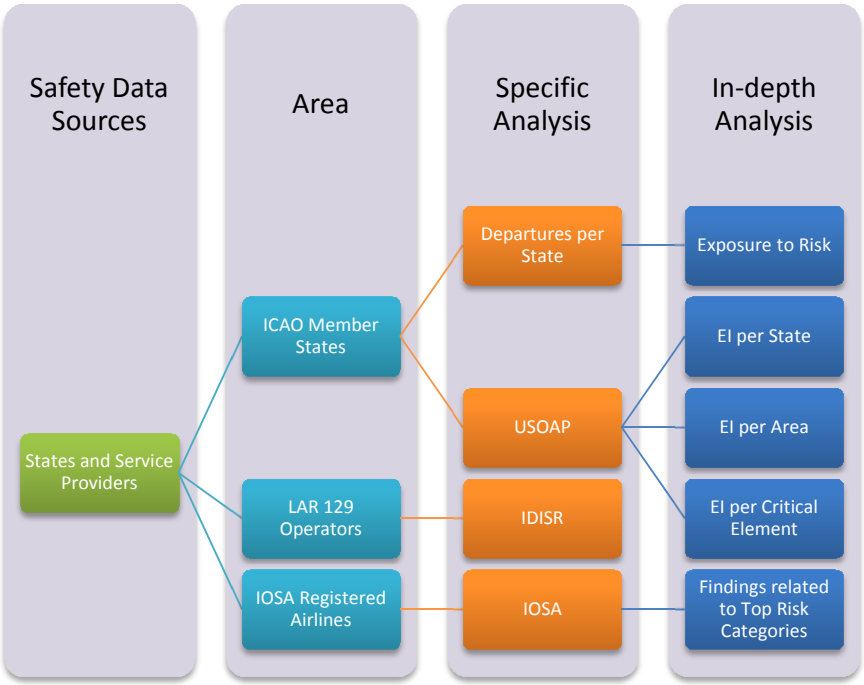


[7] IATA defines "sector" as the operation of an aircraft between takeoff at one location and landing at another location (other than a diversion).

2 Proactive Safety Information

This section contains safety information that can be categorized as proactive, which may show the level of exposure to risks based upon current safety oversight and management processes at State and/or service provider levels. The following figure depicts the extent of the analysis presented in this section.

Figure 18. Proactive Safety Data Analysis



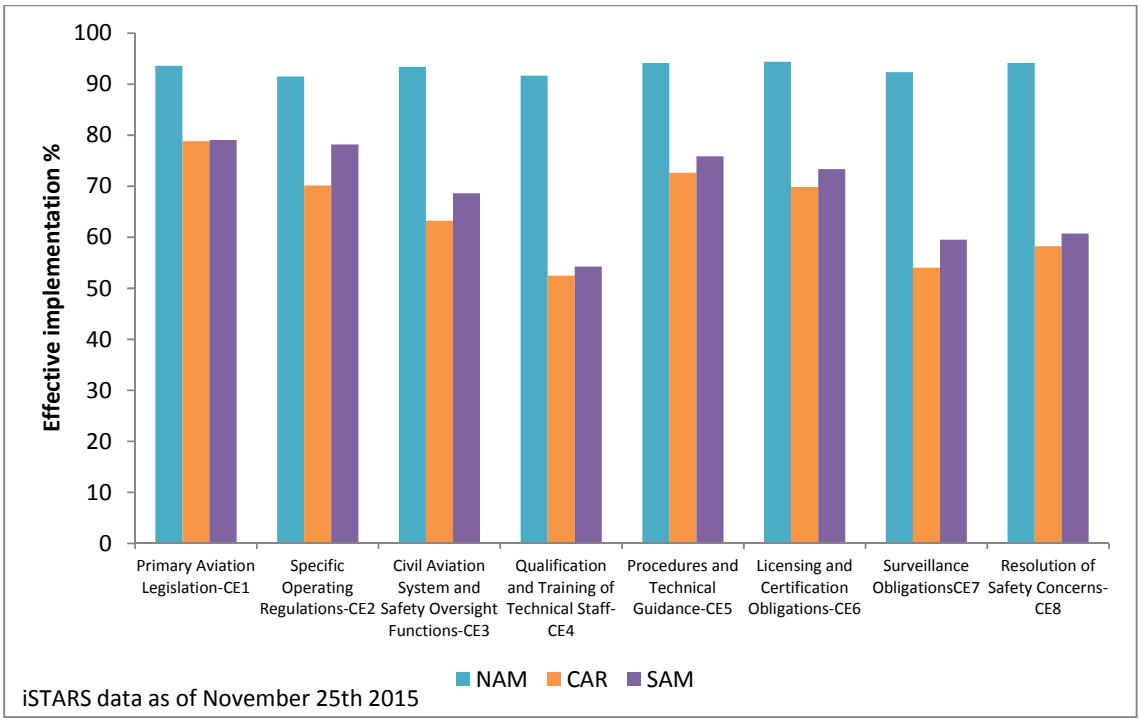
2.1 ICAO Universal Safety Oversight Audit Programme Continuous Monitoring Approach (USOAP CMA)

Results of the USOAP are presented to show the Effective Implementation (EI) by States in reference to the 8 Critical Elements (CEs), which ICAO considers essential for a State to establish, maintain and improve in order to have an effective safety oversight system.

According to ICAO iSTARS[8] (Integrated Safety Trend Analysis and Reporting System), **CE4: technical staff qualifications and training** is the top issue affecting the effective implementation percentage in the Pan American Region. This and other facts are shown in Figure 19.

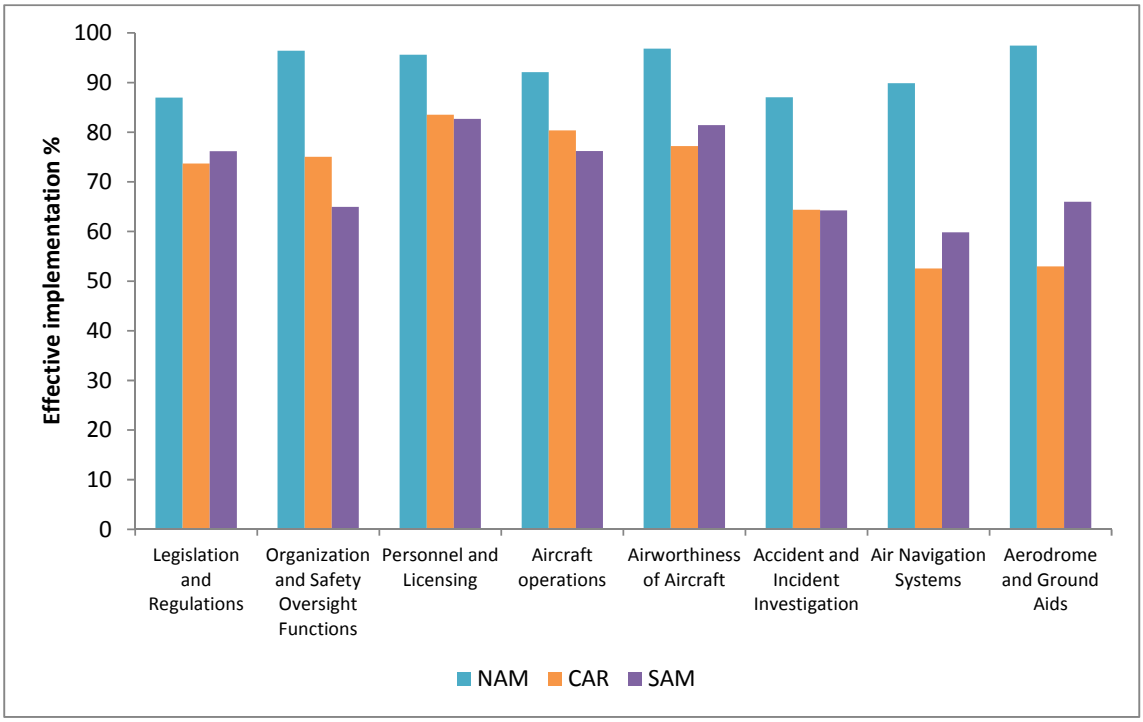
8 iSTARS data as of November 25th 2015.

Figure 19. Effective Implementation per CE by Region (ICAO iSTARS)



The results of USOAP/CMA also show the safety oversight systems of the States from a process - perspective in eight technical areas, as presented in the following graph.

Figure 20. Effective Implementation per Area by Region (ICAO iSTARS)



The following figure shows detailed distribution of the percentage of effective implementation by State in the Pan American Region.

Figure 21. Effective implementation per State by Region (ICAO iSTARS)

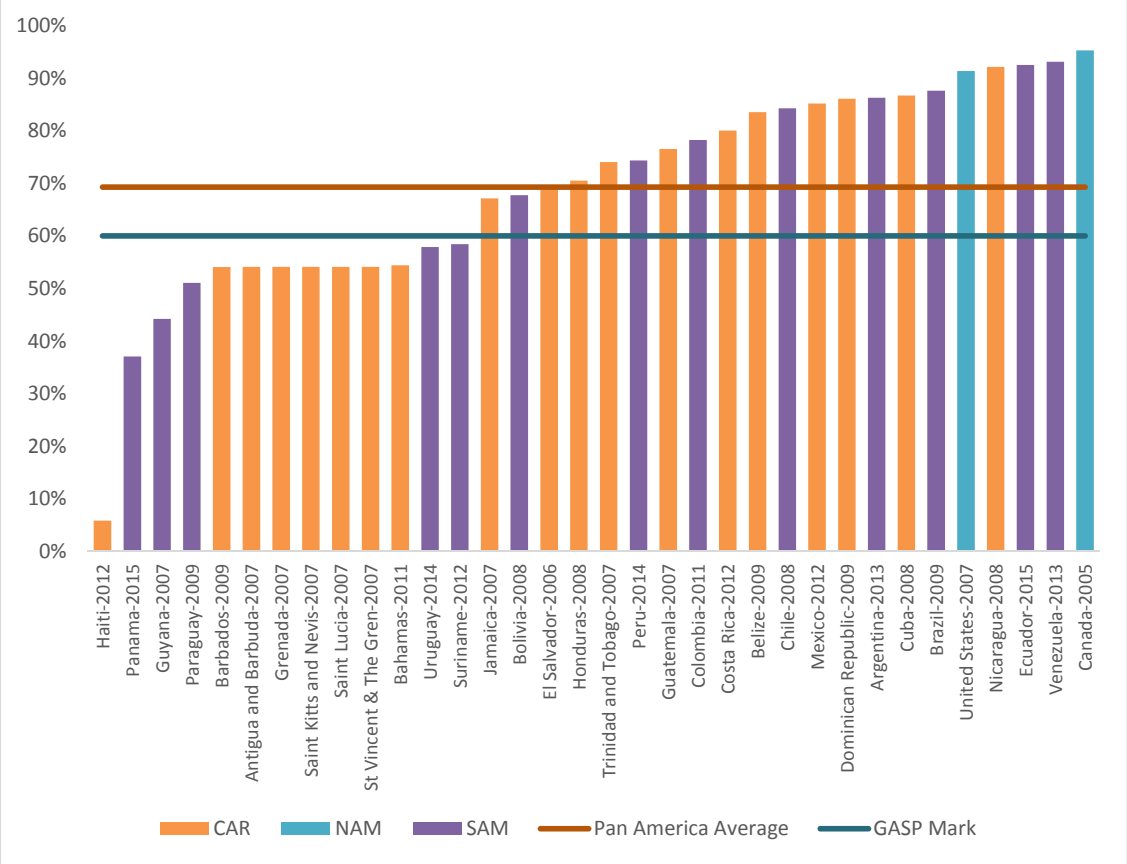


Figure 21 shows the extent of effective implementation data based upon ICAO audit programme results. The year of the last update is also presented. It should be noted that changes/improvements in States safety oversight processes can only be updated after the results of an ICAO Coordinated Validation Mission (ICVM) or a Comprehensive Systems Approach (CSA) Audit.

Figure 21 also shows the average effective implementation in the Pan American Region, which increased from 65.2% in 2010 to 69.26% as of November 25th 2015, achieved as a result of the latest audits conducted to Argentina, Bahamas, Colombia, Ecuador, Mexico, Panama, Peru, Suriname, Uruguay and Venezuela. According to ICAO Global Aviation Safety Plan (GASP), States should target their efforts to increase and maintain effective implementation above 60%. In the Pan American Region, 13 of the States audited showed effective implementation below 60%, and the averages were 93.3% for the NAM Region, 66.1% for the CAR Region and 70.2% for the SAM Region.

According to the ICAO Global Air Transport Outlook to 2030, forecasts for total Latin America and Caribbean passenger traffic call for an annual growth rate of 5.9% to 2030. By 2030, Latin America and Caribbean international markets are expected to account for 74% of the total passenger traffic from, to and within the region.

Air passenger traffic on Domestic Latin America routes is expected to grow at an average rate of 6.5% annually between 2011 and 2030. Latin America belly-cargo will become the world's fifth largest domestic market. Further, it will record the world's largest growth of domestic markets at approximately 7.9%.

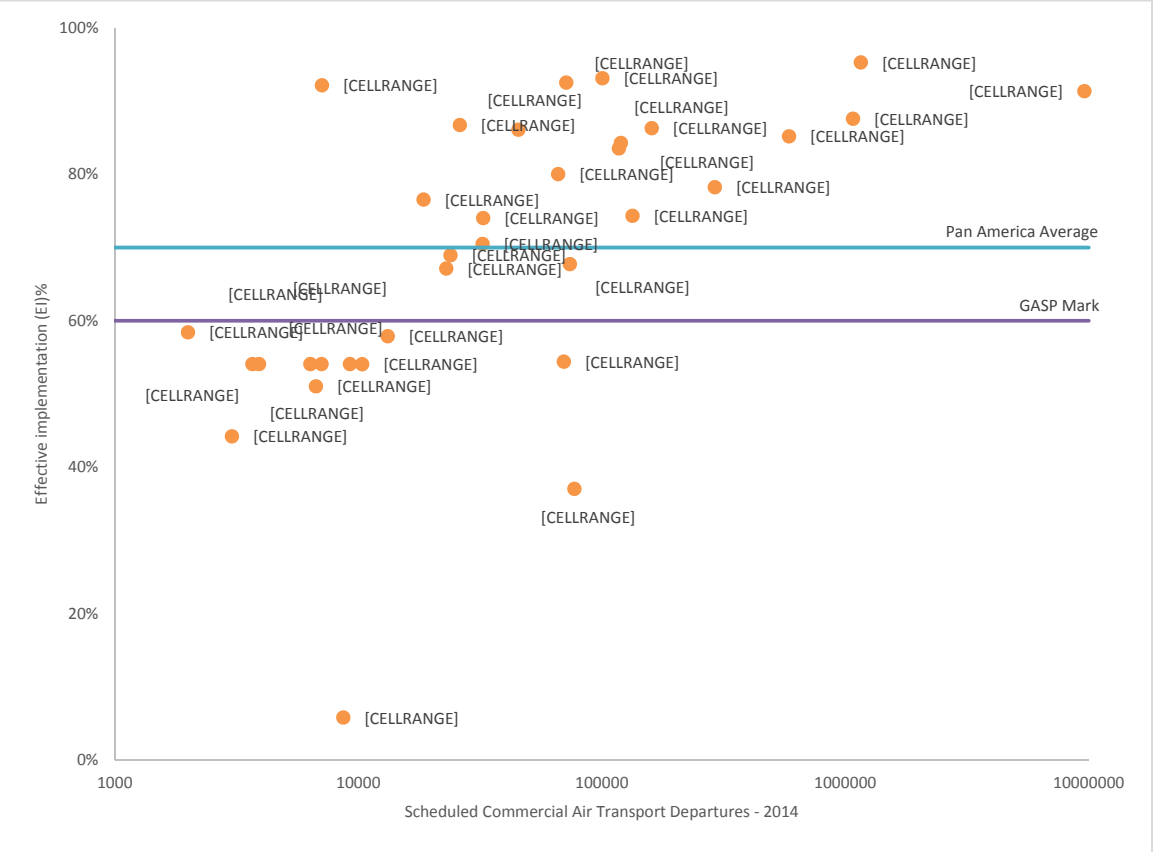
Intra Latin America passenger and belly-cargo traffic are expected to grow at an average annual rate of 7.4% and 6.0%, respectively, over the forecast period.

Considering the traffic growth, it is highly recommended that the CAR and SAM Regions continuously

monitor and improve the implementation of the ICAO SARPs that could result in minimizing exposure to the associated risks derived from traffic growth, especially in the areas of ANS, AGA and AIG, and CE4.

Figure 22 shows a comparison between effective implementation (EI) and traffic volume (departures) by Pan American States in 2014, based upon ICAO iSTARS data.

Figure 22. Effective implementation vs. 2014 Departures by State (ICAO iSTARS)



The chart above is intended to represent risk exposure of the States. Low levels of effective implementation associated with high traffic volume could indicate higher exposure to risk.

2.2 IOSA main findings per Top Risk Category

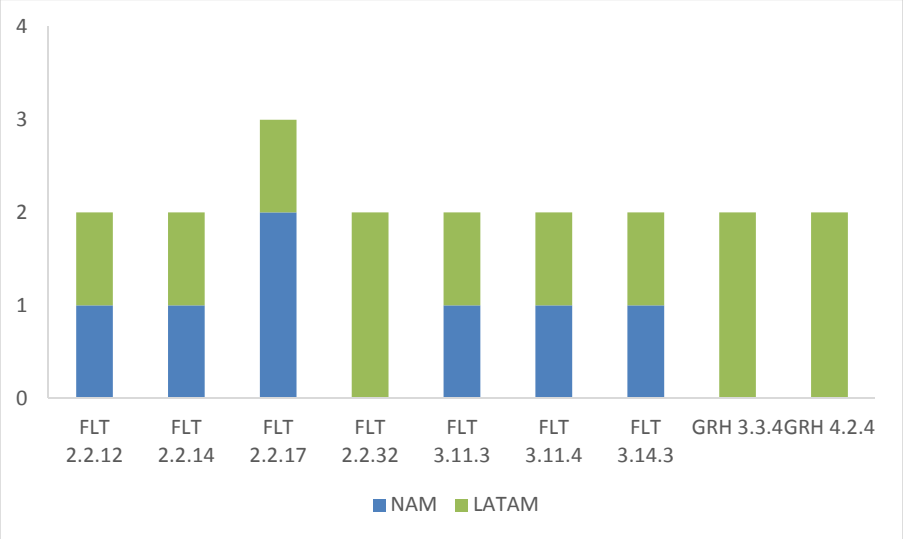
To assist operators to better understand the latent conditions related to the top three high risk accident categories, IATA prepared a review of the IOSA Standards and Recommended Practices (ISARPs) related to Loss of Control In-flight, Controlled Flight into Terrain and Runway Excursion. The following figures present the top findings and observations associated with the relevant ISARPs, based upon global data.

a) Runway Excursion IOSA findings:

The primary findings for Runway Excursions related to the operators' requirements to ensure flight crew training in procedures for upset recovery and for windshear avoidance and recovery.

The following figure shows the findings detected during IOSA audits in the Pan American Region with regard to runway/taxiway excursions

Figure 23. IOSA Findings related to Runway/taxiway excursion per Region

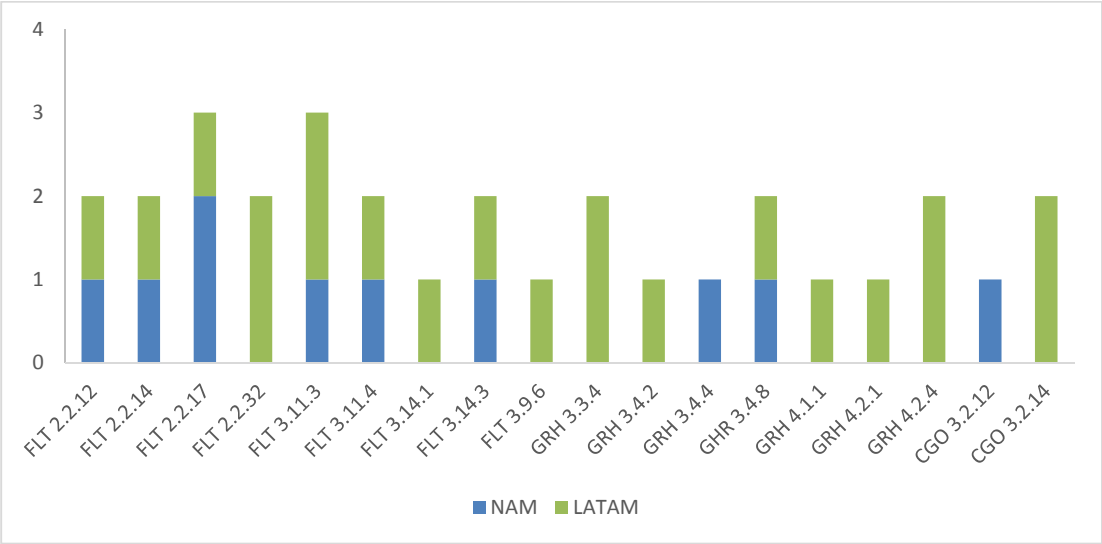


b) Loss of Control In-Flight IOSA findings:

For flight operations, the most common findings were in the operators' requirements to ensure flight crew training in procedures for upset recovery and collision avoidance policies that encourage the flight crew to maintain vigilance for conflicting visual traffic.

The following figure shows the findings detected in this category per Region.

Figure 24. IOSA Findings related to LOC-I per Region

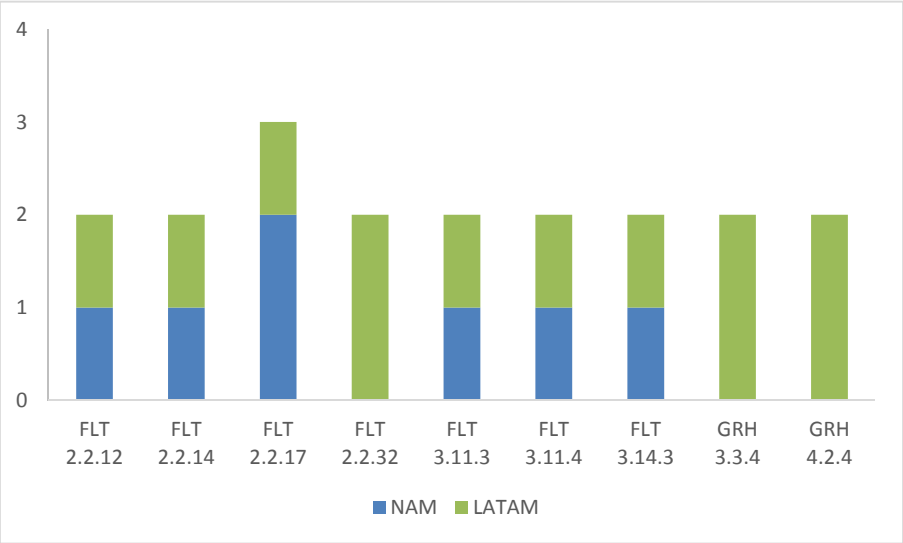


c) Controlled Flight Into terrain IOSA findings:

The primary findings for Runway Excursions related to the operators' requirements to ensure flight crew training in procedures for upset recovery and for windshear avoidance and recovery.

The following figure shows the findings related to CFIT per Region.

Figure 25. IOSA Findings related to CFIT per Region



2.3 IDISR Program

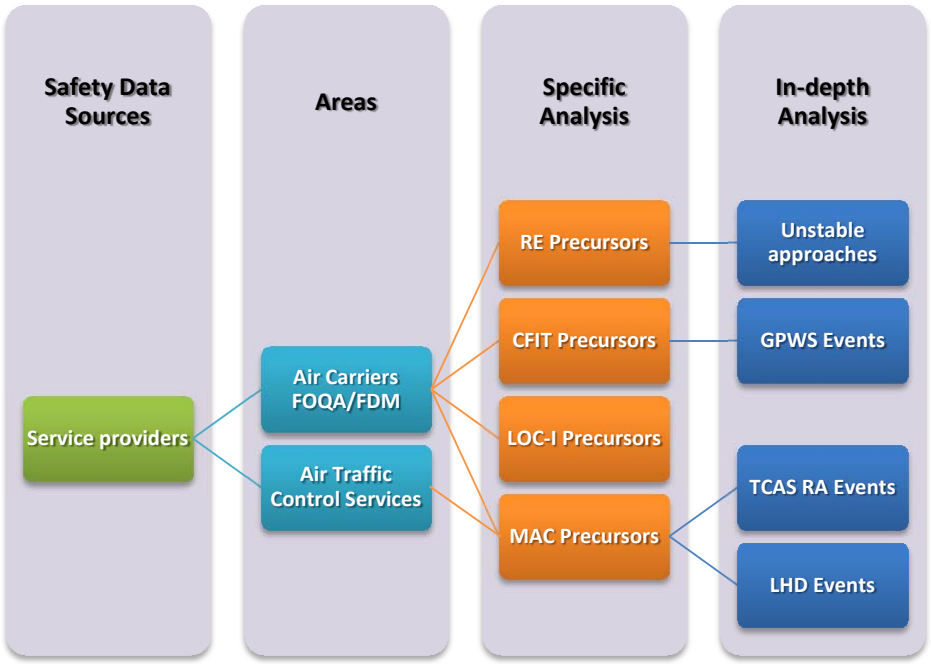
The Data Exchange Program of Ramp Safety Inspections (IDISR) is a reporting system designed to store, process and share information on ramp inspections conducted to foreign operators (under LAR 129) within the Member States of the Regional Safety Oversight Cooperation System (SRVSOP) which includes 11 States of the SAM Region and 1 from the CAR Region.

Since 2008 until 2014, IDISR recorded more than 3,000 inspections with an average of 0.421 findings per inspection. The main findings were related to external general condition, passenger/cargo cabin general condition, AOC and Operating Specs, general condition of cargo compartments and minimum equipment list.

3 Predictive Safety Information

This section contains predictive safety information, which includes the analysis of FOQA/FDA events occurred in the CAR and SAM Regions that could reveal precursors of accidents. The following figure depicts the structure of the analysis presented in this section.

Figure 26. Predictive Safety Data Analysis



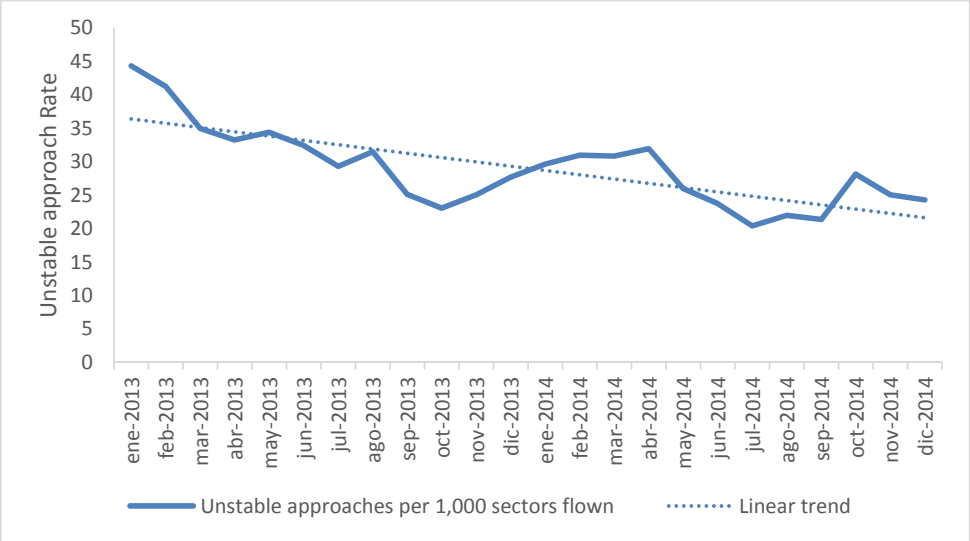
ASIAS analysis was conducted using data provided by the Flight Operations Quality Assurance (FOQA) system from 30 North American airlines that included operations in aerodromes with the following criteria: at least 2 airlines, each operating with 360 flights or greater; runways with at least 95% of confidence; and airplane fleet groups of 3 or more airlines operating in the CAR and SAM Regions. For this analysis, data from three years of flights was available.

Flight Data eXchange (FDX) is an IATA program that has been implemented in the LATAM/CAR Region in partnership with ALTA. Its analysis was conducted using data provided by the Flight Operations Quality Assurance (FOQA) system from 26 Latin American airlines that included operations in aerodromes with the following criteria: at least 3 airlines operating at an airport in the CAR and SAM Regions. For this analysis, data from January 2013 to December 2014 was available. The main findings with regard to the top accident categories are:

a) Runway Excursion Precursors:

- Unstable approaches continue to be a concern. In the case of the CAR and SAM Regions, many of the unstable approaches were spread over a few aerodromes.
- There is a decreasing trend in the number of unstable approaches that continued to land.
- IATA FDX showed a constantly decreasing trend in the rate of unstable approaches in the CAR and SAM Regions in the time period from January 2013 to December 2014, as presented in the following figure.

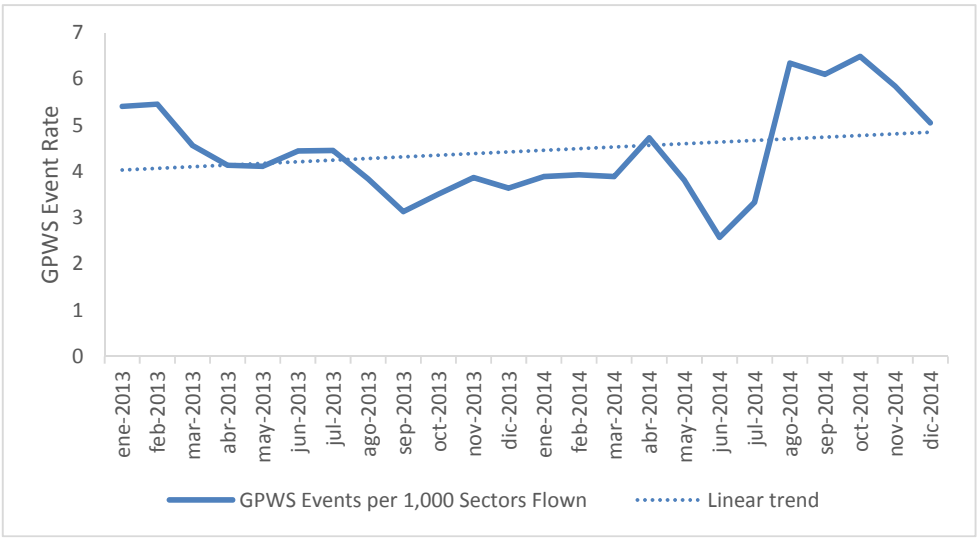
Figure 27. FDX Unstable Approach Rate Trend – CAR and SAM Regions



b) Controlled Flight Into Terrain Precursors:

- Data provided by IATA FDX program, showed a slightly increasing trend in GPWS events during the time period from January 2013 to December 2014, as presented in the following figure.

Figure 28. FDX GPWS Rate Trend – CAR and SAM Regions



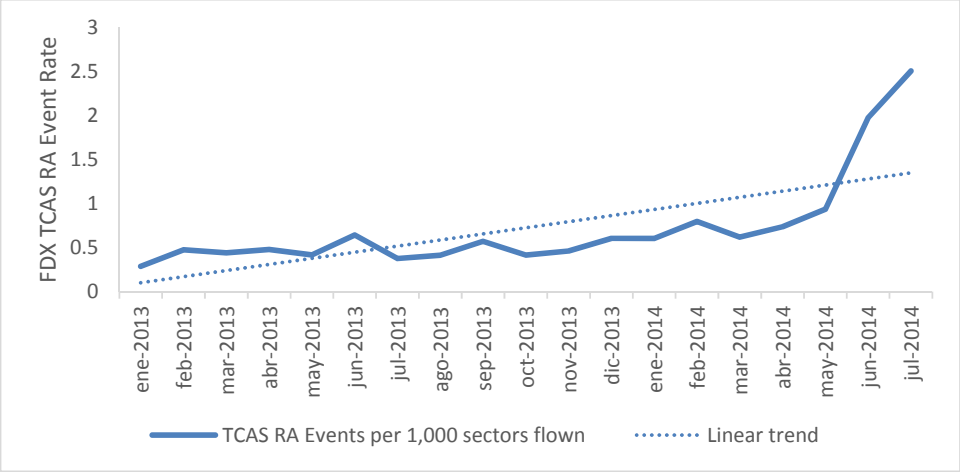
c) Loss of Control In-flight Precursors:

- Available data is being analyzed by the PA-RAST, and detailed implementation plans (DIPs) are under development.

d) Mid Air Collisions Precursors:

- Traffic Alert and Collision Avoidance System Resolution Advisory (TCAS RA) events, which can be categorized as precursors of Mid-Air Collisions, showed an increase during the time period from January 2013 to July 2014, according to data provided by IATA FDX program, as presented in the following figure.

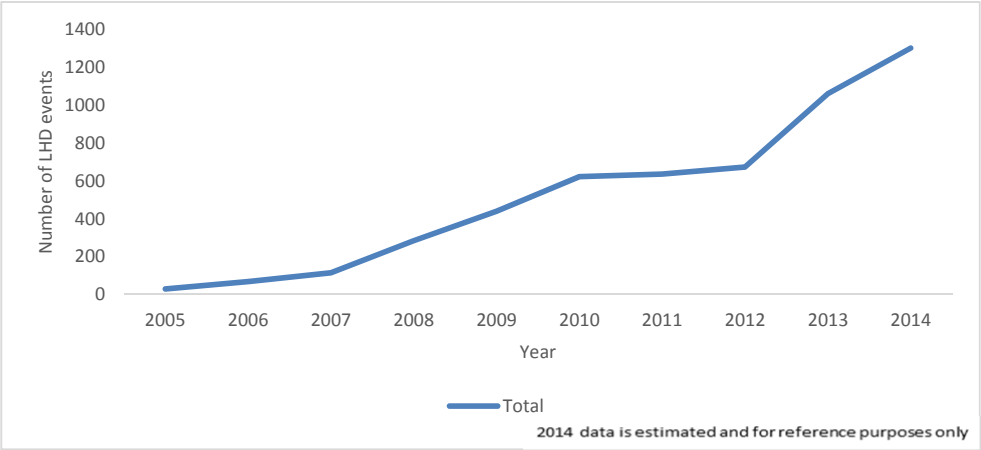
Figure 29. FDX TCAS RA Event Rate Trend – CAR and SAM Regions



- The CAR/SAM Regional Monitoring Agency (CARSAMMA), in coordination with the "Grupo de Trabajo de Escrutinios" (GTE) of GREPECAS and the States of the CAR and SAM Regions developed a methodology for analyzing and evaluating of Large Height Deviations (LHD) for the oversight of system performance and to increase the level of safety in the RVSM space of the CAR and SAM Regions, by evaluating both technical risk (affected by reliability and accuracy of aircraft avionics) and operational risk (affected by human and technological elements on ground). In 2013, the total risk was **higher** than the target level of safety (TLS) regionally agreed. Particularly, it was found a lack of effective coordination in the South Atlantic FIRs involved in controlling the traffic between Falkland and Ascension Islands, **accounting for the 25% of the total risk** in CAR and SAM Regions.

- The distribution of LHD events, for the time period from 2005 to 2014 is presented in the following figure. Note 2014 data is estimated and only used as a reference.

Figure 30. LHD events distribution per year. 2005-2014. CAR and SAM Regions (CARSAMMA)



- As shown in the previous figure, there was a significant increasing trend throughout the period. This do not actually means an increased level of risk, but further analysis should be conducted in order to determine if it could be related to an improvement in reporting culture, as a result of the long sensitization process carried out in the region since the implementation of RVSM.

Final Conclusions

This section presents the conclusions classified as follow:

a) Reactive Safety Information

- Loss of Control In-flight, Runway Excursion, and Controlled Flight into Terrain remain the top three categories of interest in the Pan American Region. It should be noted that these categories show decreasing trends across the latest ten year period (2005-2014).
- When analyzing the fatality risk during the period of interest, Mid-Air Collision (MAC) became a category of interest.

b) Proactive Safety Information

- Low levels of effective implementation (EI) of the ICAO Standards and Recommended Practices exist for 12 States in the Pan American Region according to the ICAO Universal Safety Oversight Audit Programme Continuous Monitoring Approach (USOAP CMA).
- EI associated with qualification and training of technical staff was the most significant CE affecting the Pan American Region.
- Furthermore, the increase in regional traffic, coupled with low EI in Air Navigation Services (ANS) and Aerodromes and Ground Aids (AGA) areas could generate higher exposure to risk, especially for the CAR and SAM Regions.
- A review of IOSA audits resulted in findings that could be related to the top accident categories (LOC-I, RE and CFIT), mainly regarding to collision avoidance policies and flight crew training in procedures for upset recovery and in windshear avoidance and recovery.

c) Predictive Safety Information

- Unstable approaches continue to be a concern identified as a precursor of RE, showing a decreasing trend. The same behavior was observed in the number of unstable approaches that continued to land in the CAR and SAM Regions.
- With regard to the precursors of CFIT, Ground Proximity Warning System (GPWS) related events continue to be a concern, showing a slightly increasing trend in the CAR and SAM Regions.
- Traffic Alert and Collision Avoidance System Resolution Advisory (TCAS RA) events, which can be a precursor of Mid-Air Collision showed increasing trend in the CAR and SAM Regions, especially at the end of the analyzed period.
- Large Height Deviation (LHD) events also showed an increasing trend throughout the period, but further analysis could determine if there is a relationship with an improvement in reporting culture, as a result of the long sensitization process carried out in the region since the implementation of RVSM.
- Finally, with regard to the precursors of LOC-I in the CAR and SAM Regions, data is being analyzed and new DIPs are under development.

List of Acronyms

ADREP	Accident/Incident Data Reporting System (ICAO)
ADRM	Aerodrome
AFI	Africa (IATA Region)
AIS	Aeronautical Information Service
AMAN	Abrupt manoeuvre
ARC	Abnormal runway contact
ASPAC	Asia/Pacific (IATA Region)
ASRT	Annual Safety Report Team
ATM	Air Traffic Management, Communications, Surveillance
BIRD	Birdstrike
CABIN	Cabin safety events
CAR	Caribbean (ICAO Region)
CAST	Commercial Aviation Safety Team
CEs	Critical Elements (ICAO)
CFIT	Controlled flight into terrain
CGO	Cargo Operations (IOSA)
CIS	Commonwealth of Independent States (IATA Region)
CMA	Continuous monitoring approach
DGAC	Directorate General of Civil Aviation
DIPs	Detailed Implementation Plans
ECCAIRS	European Coordination Centre for Accident and Incident Reporting Systems
E-GPWS	Enhanced Ground Proximity Warning System
EI	Effective Implementation of ICAO SARPs
EUR	Europe (ICAO and IATA Region)
EVAC	Evacuation
FDA	Flight Data Analysis
FLT	Flight Operations (IOSA)
F-NI	Fire/smoke (none-impact).
FOQA	Flight Operations Quality Assurance
F-POST	Fire/Smoke (post-impact)
FUEL	Fuel related
GASP	ICAO Global Aviation Safety Plan
GCOL	Ground collision
GPWS	Ground Proximity Warning System
GRH	Ground Handling Operations (IOSA)
GSI	Global Safety Initiative
ICAO	International Civil Aviation Organization
ICE	Icing
IMC	Instrument meteorological conditions
IOSA	IATA Operational Safety Audit
ISTARS	ICAO Integrated Safety Trend Analysis and Reporting System
LALT	Low altitude operations
LATAM/CAR	Latin America and Caribbean (IATA Region)
LOC-G	Loss of control - ground
LOC-I	Loss of control - inflight
MAC	AIRPROX/TCAS alert/loss of separation/near miss collisions/mid-air collisions
MNT	Aircraft Engineering and Maintenance (IOSA)
MENA	Middle East and North Africa (IATA Region)
MTOM	Maximum Take-off Mass
NAM	North America (ICAO and IATA Region)
NASIA	North Asia (IATA Region)
OTHR	Other
ORG	Organization and Management System (ORG)
PA-RAST	Pan America – Regional Aviation Safety Team
RA	Resolution Advisory
RAMP	Ground handling operations
RASG-PA	Regional Aviation Safety Group – Pan America
RE	Runway excursion (departure or landing)
RI	Runway Incursion
RI-A	Runway Incursion – Animal
RI-VAP	Runway Incursion – vehicle, aircraft or person
SAM	South America (ICAO Region)
SARPS	Standards and Recommended Practices (ICAO)
SEC	Security Management (IOSA)
SEIs	Safety Enhancement Initiatives
SCF-NP	System/component failure or malfunction (non-powerplant)
SCF-PP	Powerplant failure or malfunction
SEC	Security-related
SOP	Standard Operating Procedure
SRVSOP	Regional Safety Oversight System
TCAS	Traffic Collision and Avoidance System
TCAS RA	Traffic Collision and Avoidance System-Resolution Advisory
TEM	Threat and Error Management
TURB	Turbulence encounter
UNK	Unknown or Undetermined
USOAP	Universal Safety Oversight Audit Programme
USOS	Undershoot/Overshoot
WSTRW	Wind shear or thunderstorm

CREDITS – CRÉDITOS

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Winston San Martin

Dirección General de Aeronáutica Civil – Chile

Gerardo Hueto

The Boeing Company

Gabriel Acosta

International Air Transport Association – IATA

Oscar Quesada

International Civil Aviation Organization – ICAO/OACI

Eduardo Chacin

International Civil Aviation Organization – ICAO/OACI

Marcelo Ureña

International Civil Aviation Organization – ICAO/OACI

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International Civil Aviation Organization (ICAO) + States + International Organizations + Industry
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