



INTERNATIONAL CIVIL AVIATION ORGANIZATION

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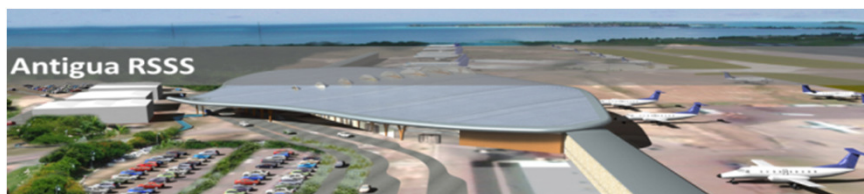
Introduction of Safety Risk Management and NAM/CAR & SAM Regional Examples of Runway Excursions

ICAO/IFALPA

NAM/CAR Regional Runway Safety Seminar (RRSS)

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**Eduardo Chacin
Flight Safety Officer
ICAO NACC Regional Office**



Safety facts



- The elimination of accidents (and serious incidents) is unachievable
- Failures will occur, in spite of the most accomplished prevention efforts
- No human activity or human-made system can be guaranteed to be absolutely free from hazard and operational errors
- Controlled safety risk and controlled error are acceptable in an inherently safe system

Concept of safety



ICAO Doc 9859:

- Safety is the state in which the possibility of harm to persons or property damage is reduced to, and maintained at or below, an acceptable level through a continuing process of **hazard identification** and **risk management**



Key definitions



- **Hazard:** condition or object 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
- **Consequence:** potential outcome(s) of the hazard
- **Safety 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

Other important definitions



- **Probability:** the likelihood that an unsafe event or condition might occur
- **Severity:** the possible effects of an unsafe event or condition, taking as reference the worst foreseeable situation



Hazard analysis



State the generic hazard

(Hazard statement)

- Airport construction

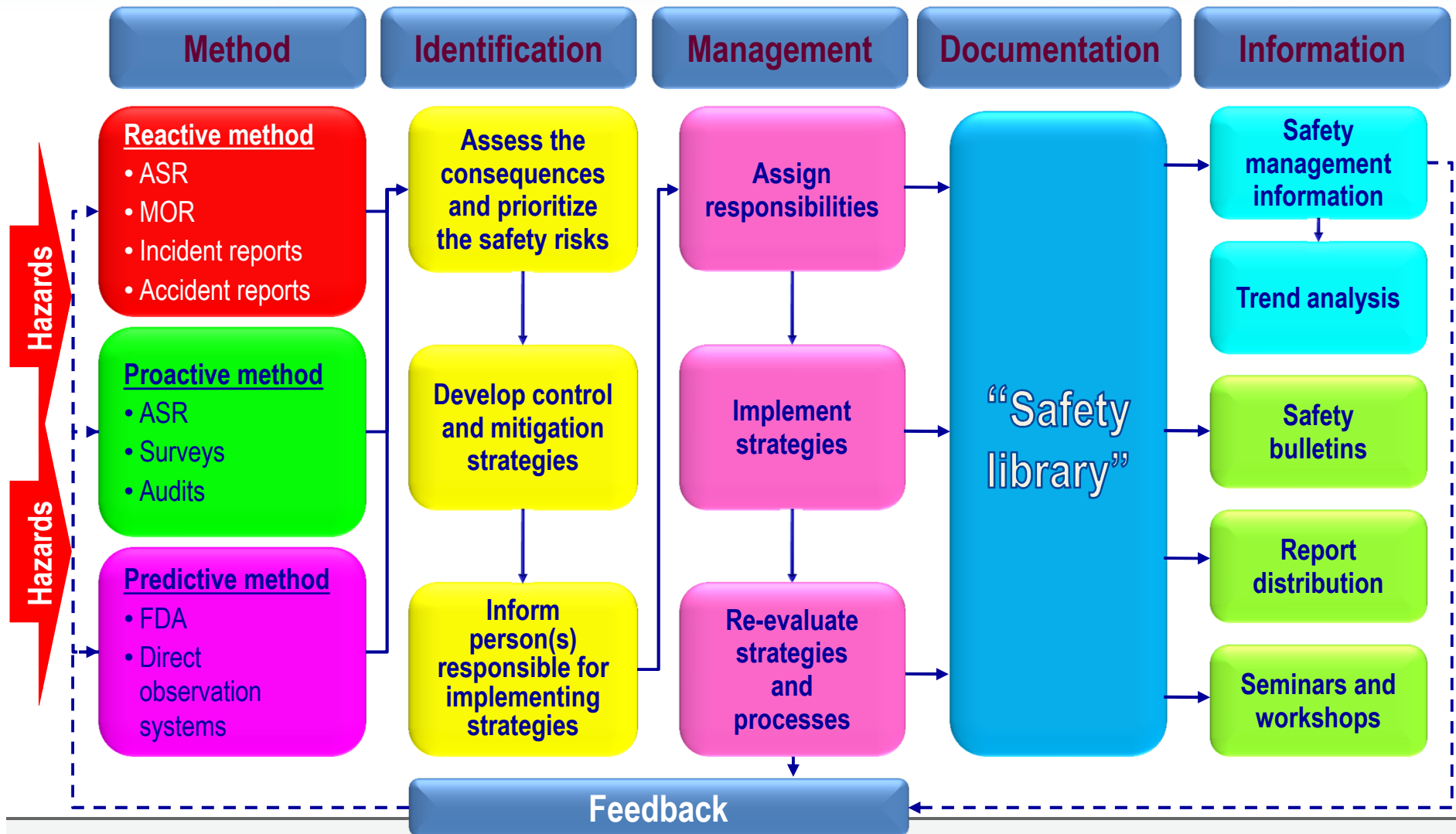
Identify specific components of the hazard

- Construction equipment
- Closed taxiways
- Etc.

Naturally leading to specific consequence(s)

- Aircraft colliding with construction equipment
- Aircraft taking wrong taxiway
- Etc.

Documentation of hazards

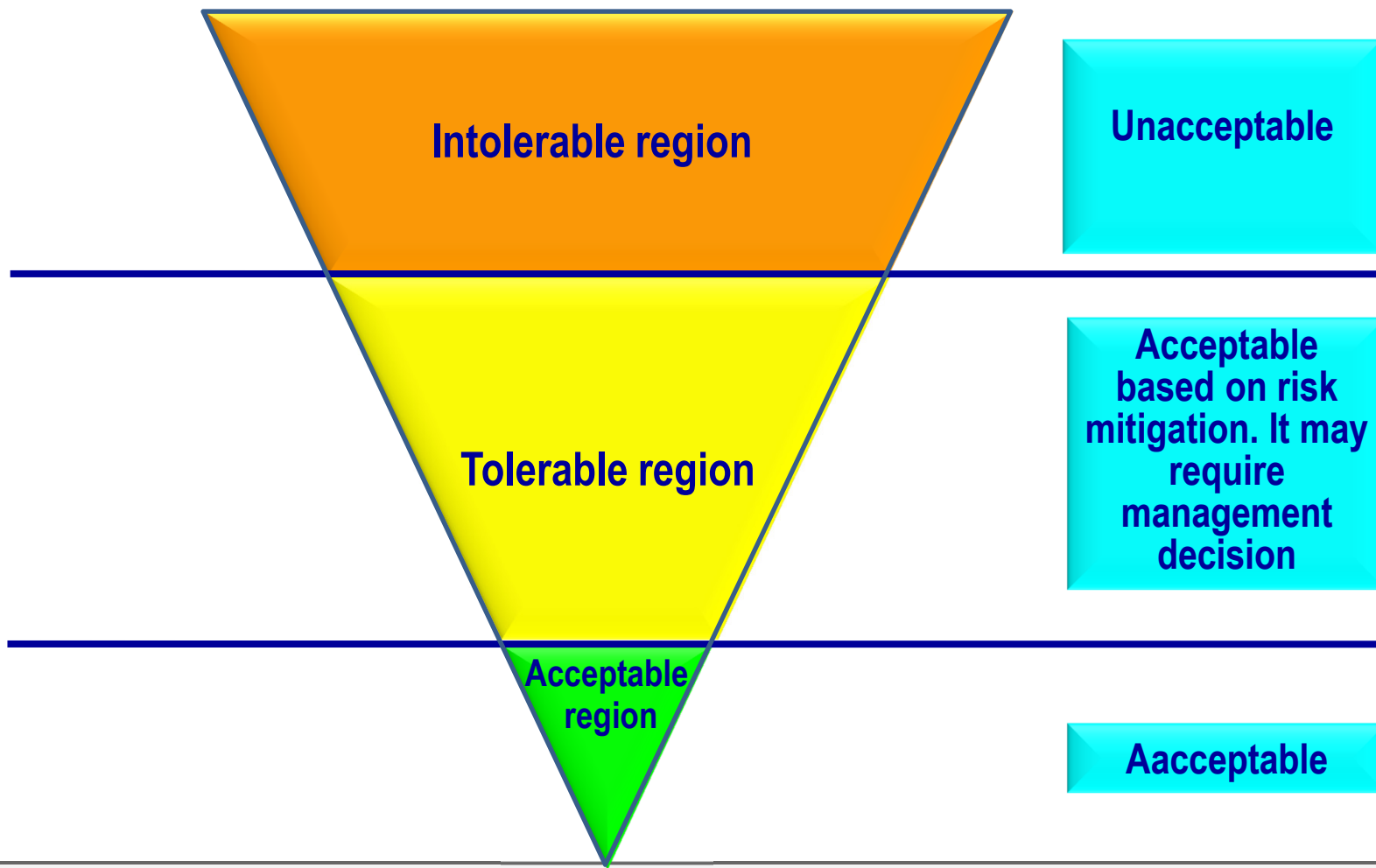


Safety risk management (SRM)



- Definition:
 - The analysis and elimination, and/or mitigation to an acceptable level of the safety risks of the consequences of identified hazards
- Objective:
 - A balanced allocation of resources to address all safety risks and viable safety risks control and mitigation
- Importance:
 - Data-driven approach to safety resources allocation, thus defensible and easier to explain

Safety risk tolerability matrix

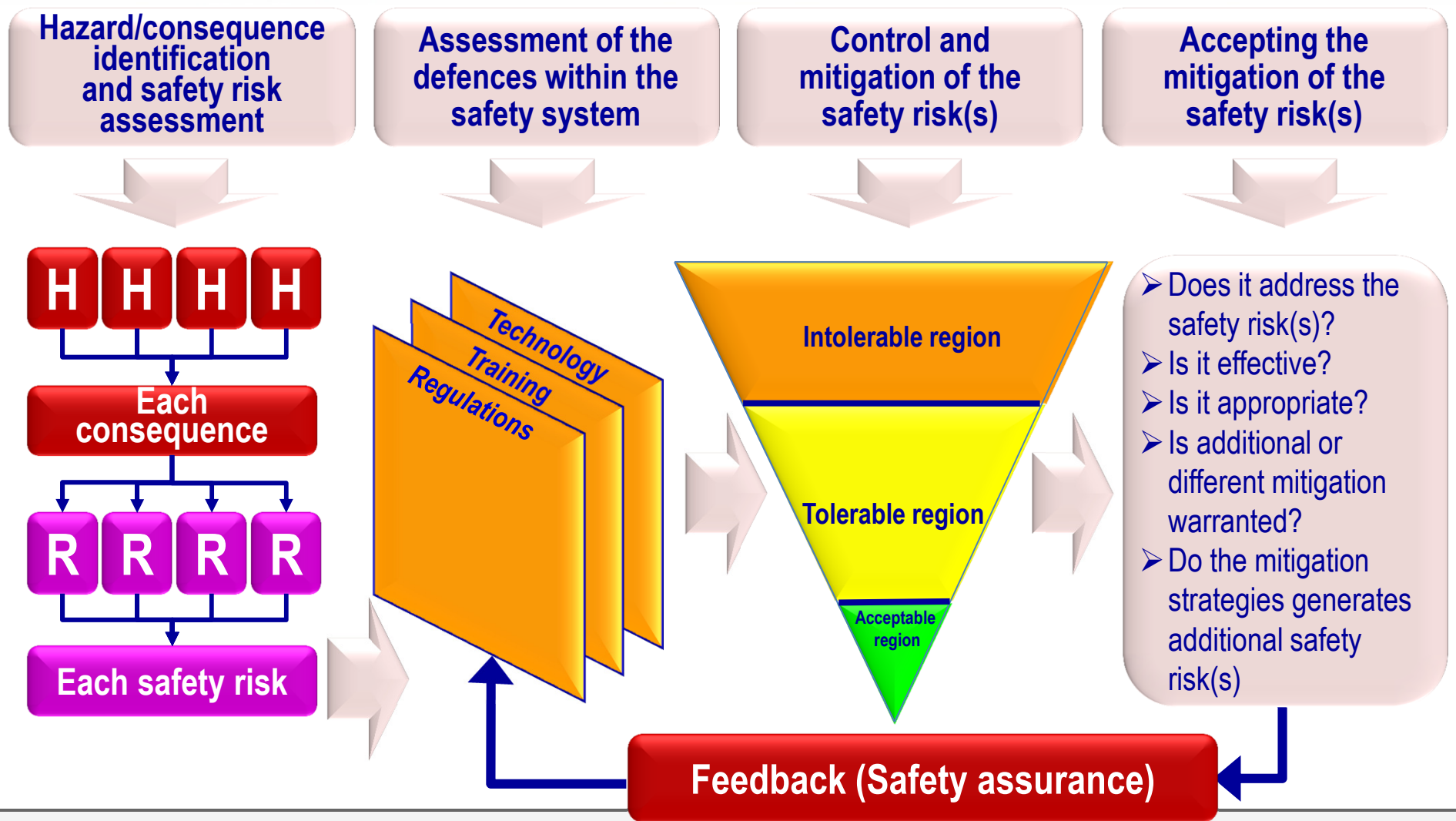


Safety risk assessment matrix



Safety risk probability	Safety risk severity				
	Catastrophic A	Hazardous B	Major C	Minor D	Negligible E
Frequent 5	5A	5B	5C	5D	5E
Occasional 4	4A	4B	4C	4D	4E
Remote 3	3A	3B	3C	3D	3E
Improbable 2	2A	2B	2C	2D	2E
Extremely improbable 1	1A	1B	1C	1D	1E

Safety risk mitigation at a glance



Contributing Factors - IATA



Top Contributing Factors for NATNAM Region Accidents - 2012

Latent Conditions (deficiencies in...)	Threats	Flight Crew Errors (relating to...)	Undesired Aircraft States (UAS)
<ul style="list-style-type: none"> 8% Regulatory oversight 8% Change management 8% Flight operations: training systems 	<p>Environmental</p> <ul style="list-style-type: none"> 23% Airport facilities <ul style="list-style-type: none"> Contaminated runway/taxiway or poor breaking action (67% of these cases) Inadequate overrun area/trench/ditch/proximity of structures (33% of these cases) 15% Meteorology: <ul style="list-style-type: none"> Wind/windshear/gusty wind (50% of these cases) Poor visibility/IMC (50% of these cases) <p>Airline</p> <ul style="list-style-type: none"> 23% Grounds events 8% Aircraft malfunction: Gear/tire 	<ul style="list-style-type: none"> 15% Manual handling/flight controls 8% Crew to external communication: ground crew 	<ul style="list-style-type: none"> 15% Long/floated/bounced/firm/off-center/crabbed landing 8% Vertical/lateral/speed deviation

Contributing Factors – IATA cont.



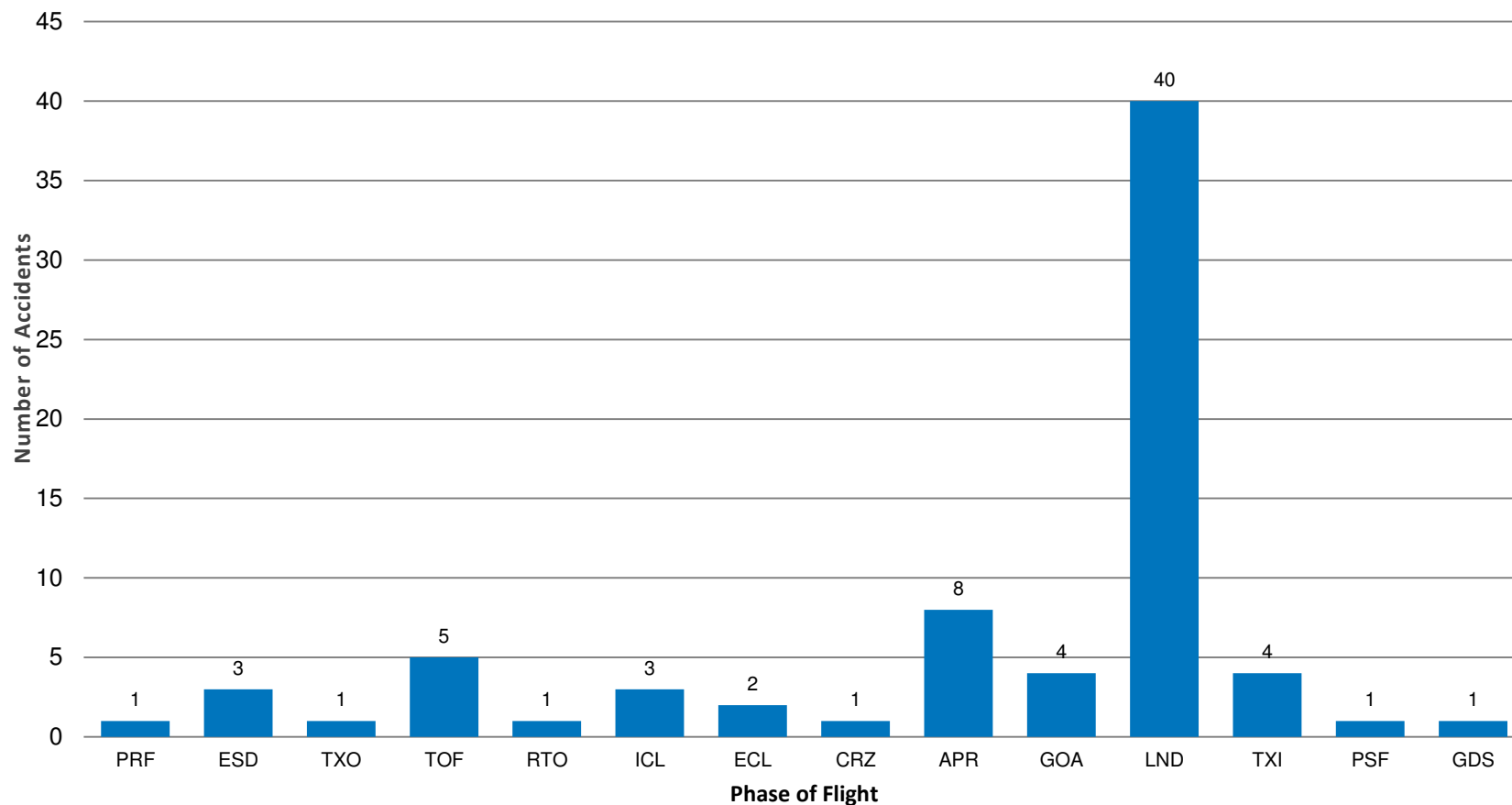
Top Contributing Factors for LATAM/CAR Region Accidents - 2012

Latent Conditions (deficiencies in...)	Threats	Flight Crew Errors (relating to...)	Undesired Aircraft States (UAS)
<p>25% Maintenance operations: Maintenance ops: SOPs & checking (100% of cases) Maintenance ops: training systems (100% of cases)</p> <p>25% Safety management</p>	<p>Environmental</p> <p>25% Airport facilities: Contaminated runway/taxiway – poor braking action</p> <p>25% Ground-based nav aids malfunctioning or not available</p> <p>Airline</p> <p>50% Aircraft malfunction: Brakes (50% of cases) Gear/tire (50% of cases)</p>	<p>None noted.</p>	<p>25% Unstable approach</p> <p>25% Vertical/lateral/speed deviation</p> <p>25% Continued landing after unstable approach</p> <p>25% Long/floated/bounced/firm/off-center/crabbed landing</p> <p>25% Loss of aircraft control while on the ground</p>

Accidents per Phase of Flight - IATA



World Wide Accidents per Phase of Flight 2012



30-05-2008, Tegucigalpa, Honduras



30-05-2008, Tegucigalpa, Honduras



- The wind information given by the ATC at Tegucigalpa was 190°/10kt and confirmed that the runway was wet.
- The aircraft landing weight was 63.5t (max landing weight 64.5t) and a Vapp of 137kt.
- At touch down, IAS was 139kt and Ground Speed (GS) was 159kt (estimated tailwind was 12kt from DFDR data analysis).
- Runway 02 is 3297 feet high and has a displaced threshold of 213m.
- The Landing Distance Available (LDA) for runway 02 is 1649m.

30-05-2008, Tegucigalpa, Honduras



- The touch down occurred at approximately 400m from the runway 02 displaced threshold
- Immediately after touch down, the crew selected MAX REV, and both engine reversers and the ground spoilers deployed normally.
- The crew applied manual braking 4s after main landing gear touch down and commanded maximum pedal braking 10 seconds later.
- At 70kt IAS, upon call-out of the copilot, the captain selected IDLE REV.
- The remaining distance to the runway end was approximately 190m.
- The aircraft overran the runway at 54kt and dropped down the 20 m embankment and onto a street, sustaining severe damage on impact with the ground.
- Total: Fatalities: 3 / Occupants: 124
- Ground casualties: Fatalities: 2

20-12-2008, Denver, CO, USA



20-12-2008, Denver, CO, USA



- A Boeing 737-500, departed the left side of runway 34R during takeoff from Denver International Airport (DEN).
- There were 37 injuries among the passengers and crew, and no fatalities.
- The airplane was substantially damaged and experienced a post-crash fire.
- The weather observation in effect at the time of the accident was reported to be winds at 290 and 24 knots with gusts to 32 knots, visibility of 10 miles, a few clouds at 4000 feet and scattered clouds at 10,000 feet. The temperature was reported as -4 degrees Celsius.

20-12-2008, Denver, CO, USA



PROBABLE CAUSE:

- "The National Transportation Safety Board determines that the probable cause of this accident was the captain's cessation of right rudder input, which was needed to maintain directional control of the airplane, about 4 seconds before the excursion, when the airplane encountered a strong and gusty crosswind that exceeded the captain's training and experience.
- Contributing to the accident were the following factors:
 - an air traffic control system that did not require or facilitate the dissemination of key, available wind information to the air traffic controllers and pilots; and
 - inadequate crosswind training in the airline industry due to deficient simulator wind gust modeling."

22-12-2009, Kingston, Jamaica



22-12-2009, Kingston, Jamaica



- A Boeing 737-823 sustained substantial damage in a runway excursion accident on landing at Kingston-Norman Manley International Airport (KIN), Jamaica.
- The six crew members and 148 passengers survived the accident.
- The plane suffered a runway excursion on landing on runway 12 during a rainstorm.
- The plane skidded across a road and came to rest on a beach.
- The plane's fuselage was cracked, its right engine broke off from the impact and the left main landing gear collapsed.

30-07-2011 Georgetown, Guyana



30-07-2011 Georgetown, Guyana



- A Boeing 737-800 passenger plane was destroyed when it suffered a runway excursion accident at Georgetown-Cheddi Jagan International Airport (GEO), Guyana.
- One serious and multiple minor injuries were reported among the 156 passengers and six crewmembers on board the plane.
- The airplane landed on runway 06 (a 2,270-m long asphalt runway) but failed to stop on the runway surface.
- It overran and came to rest near a 61-m ravine.
- The airplane broke in two.

26-05-2013, Port Au Prince, Haiti



26-05-2013, Port Au Prince, Haiti



- A Boeing KC-137E sustained substantial damage in a runway excursion accident at Port-au-Prince Airport (PAP), Haiti.
- There were no injuries among the 12 crew members and 131 passengers on board.
- Upon takeoff an engine caught fire and the takeoff was aborted.
- The airplane veered into the grass.
- There were burn marks visible on the plane, and its front landing-gear had snapped off.

Summary



- RE has many other precursors than unstable approach
- Despite of all the efforts REs continue
- Hazard identification and risk management are important
- Data sharing and collaborative effort will be key
- Deficiencies in airport facilities, wildlife, NAV aids are contributing factors for accidents in LATAM/CAR
- States must comply with ICAO SARPs and eliminate deficiencies
- The implementation of an effective Runway Safety Team in your location would contribute to enhance runway safety
- Safety promotion must be an ongoing activity



North American
Central American
and Caribbean
(NACC) Office
Mexico City

South American
(SAM) Office
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Headquarters
Montreal**

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Central African
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Dakar

European and
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Cairo

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Southern African
(ESAF) Office
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Asia and Pacific
(APAC) Office
Bangkok

Thank You

Contact: Eduardo Chacin
echacin@icao.int

Visit: www.mexico.icao.int

<http://www.icao.int/safety/RunwaySafety/Pages/Toolkits.aspx>