# Preventing Runway Excursions

# Pilots Training Kit (Risks and Lessons Learned)

# Purpose of This Presentation

Runway excursions are the most common types of accidents

**Purpose:**

- To identify the threats and errors that lead to runway excursions
- To share the lessons learned from past accidents

**Objective:**

- To reduce the rate of these types of accidents in the future

# Overview

- What is a Runway Excursion
- Runway Excursion Analysis
- Takeoff Risk Factors
- Landing Risk Factors

# What is a Runway Excursion?

- When an aircraft on the runway surface departs the end or the side of the runway surface
- Runway excursions can occur on takeoff or landing. They consist of two types of events:
  - **Veer Off:** A runway excursion in which an aircraft departs the side of a runway
  - **Overrun:** A runway excursion in which an aircraft departs the end of a runway

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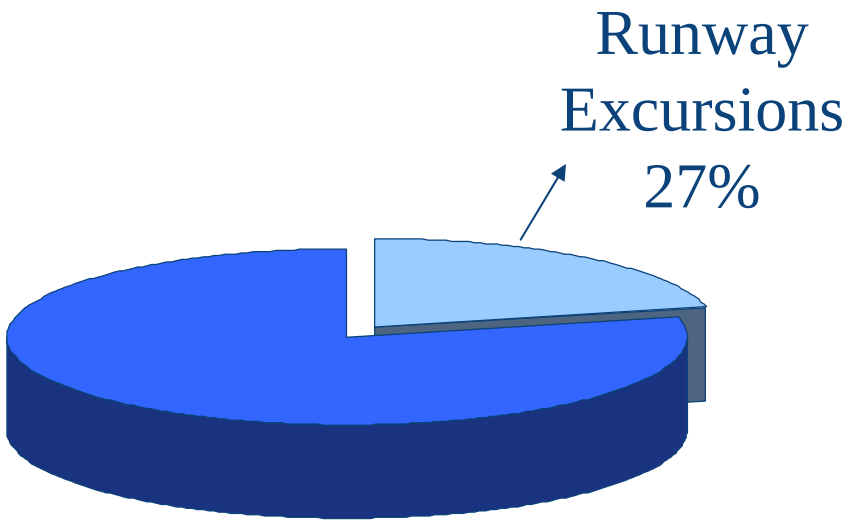
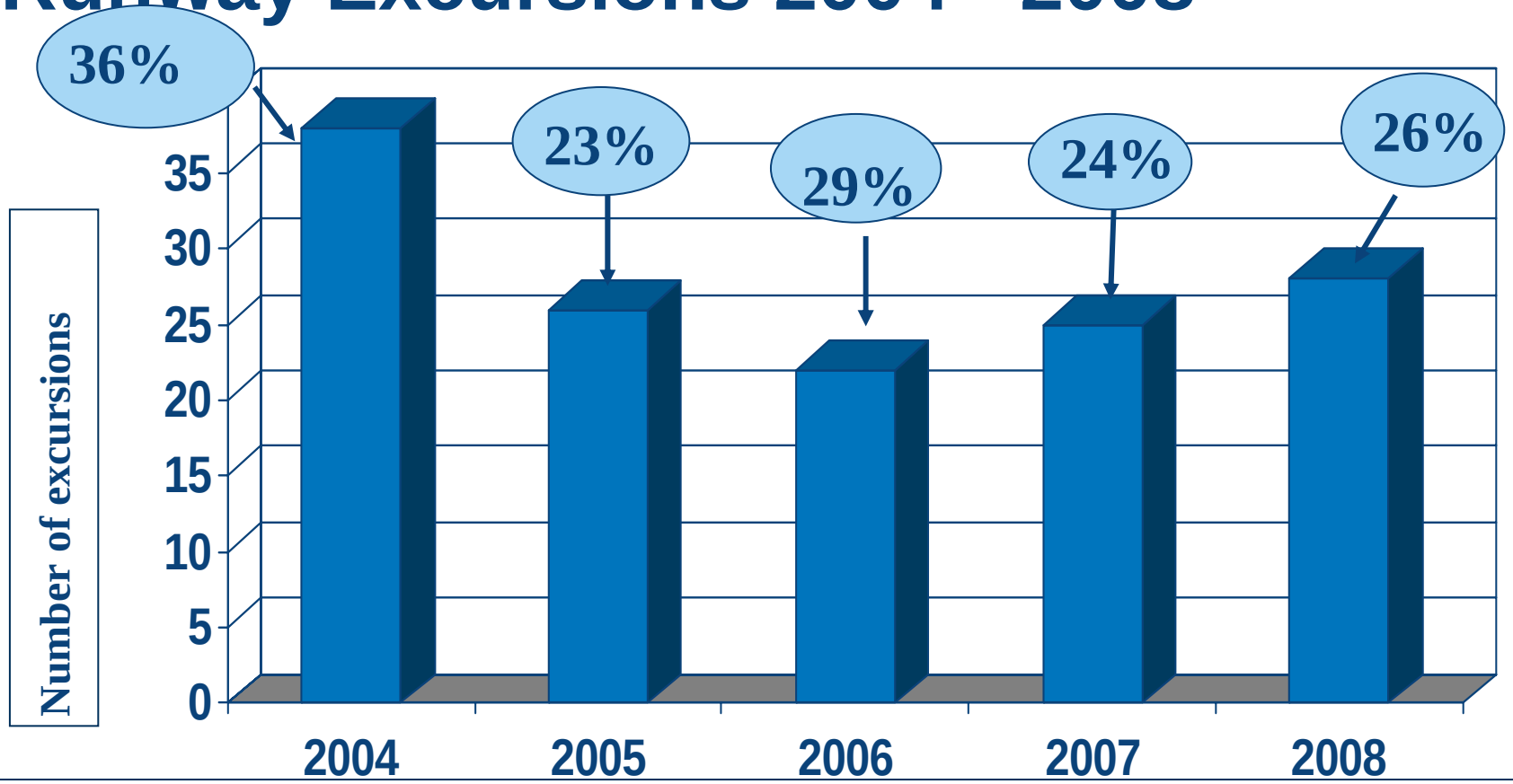
# Commercial Transport Accident History
# IATA Safety Reports 2004-2008

There were 501 total commercial accidents during this period:

- ↗136 of these accidents were runway excursions
- ↗17 runway excursion accidents involved fatalities
- ↗This resulted in a total of 463 passenger and crew fatalities



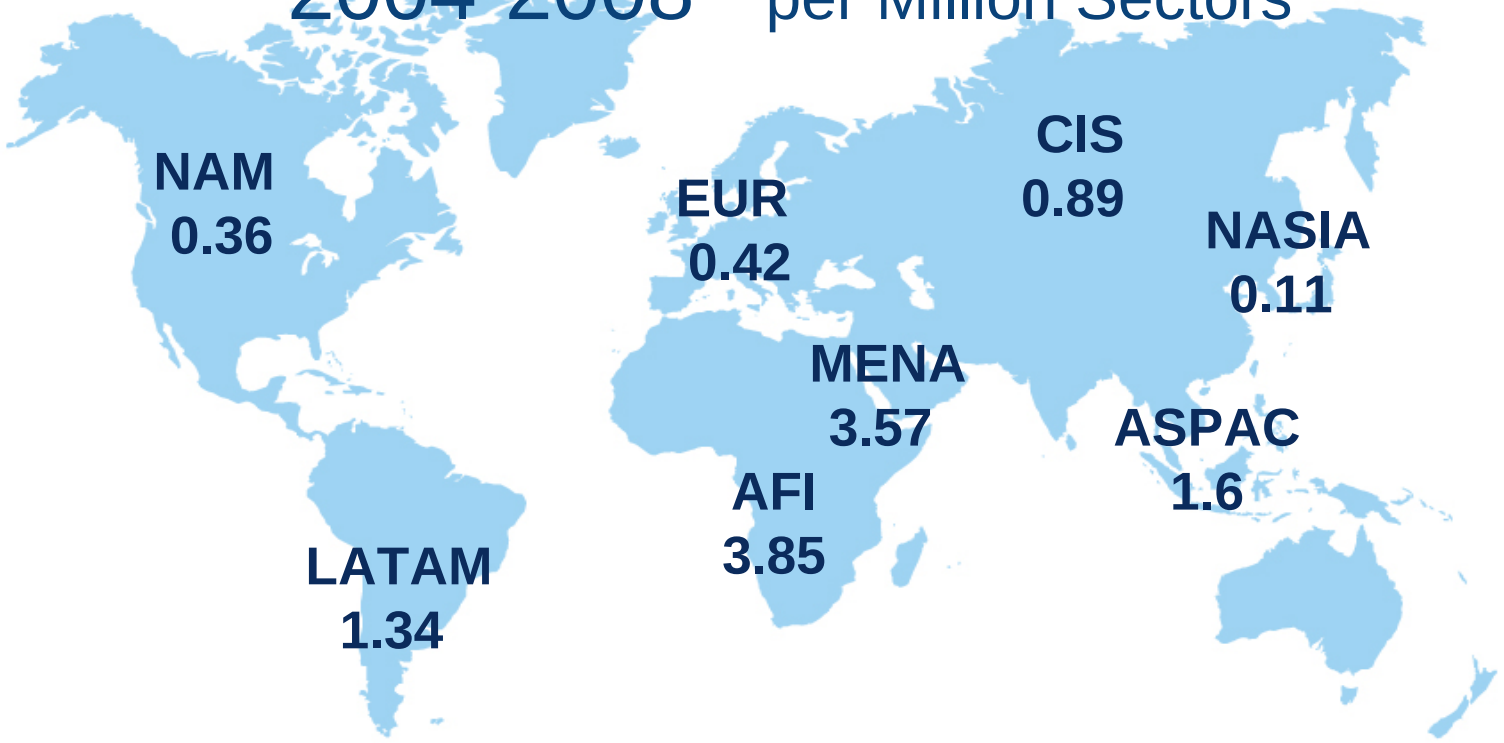
# Runway Excursions 2004 - 2008




The % is relative to the total number of accidents during that year

# Runway Excursions - Regional Rates

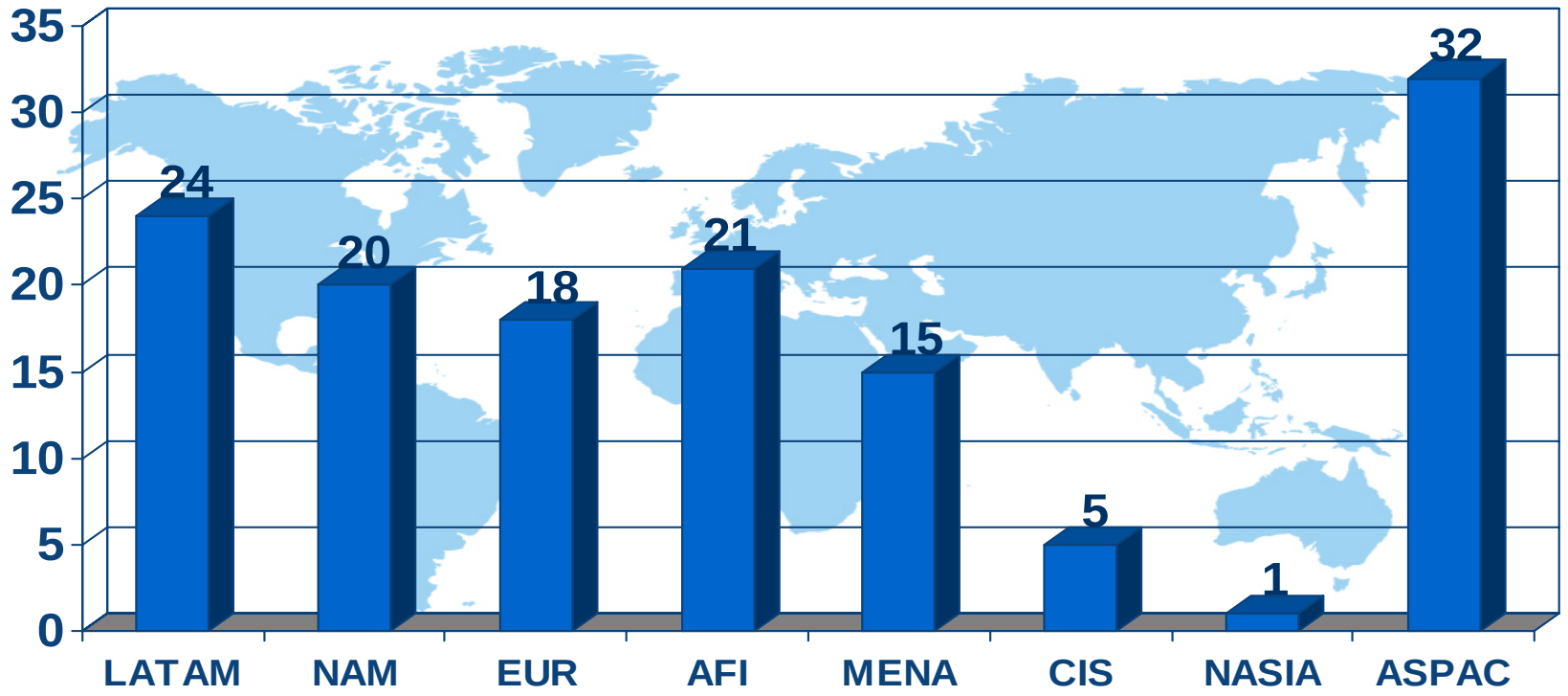
2004-2008 per Million Sectors



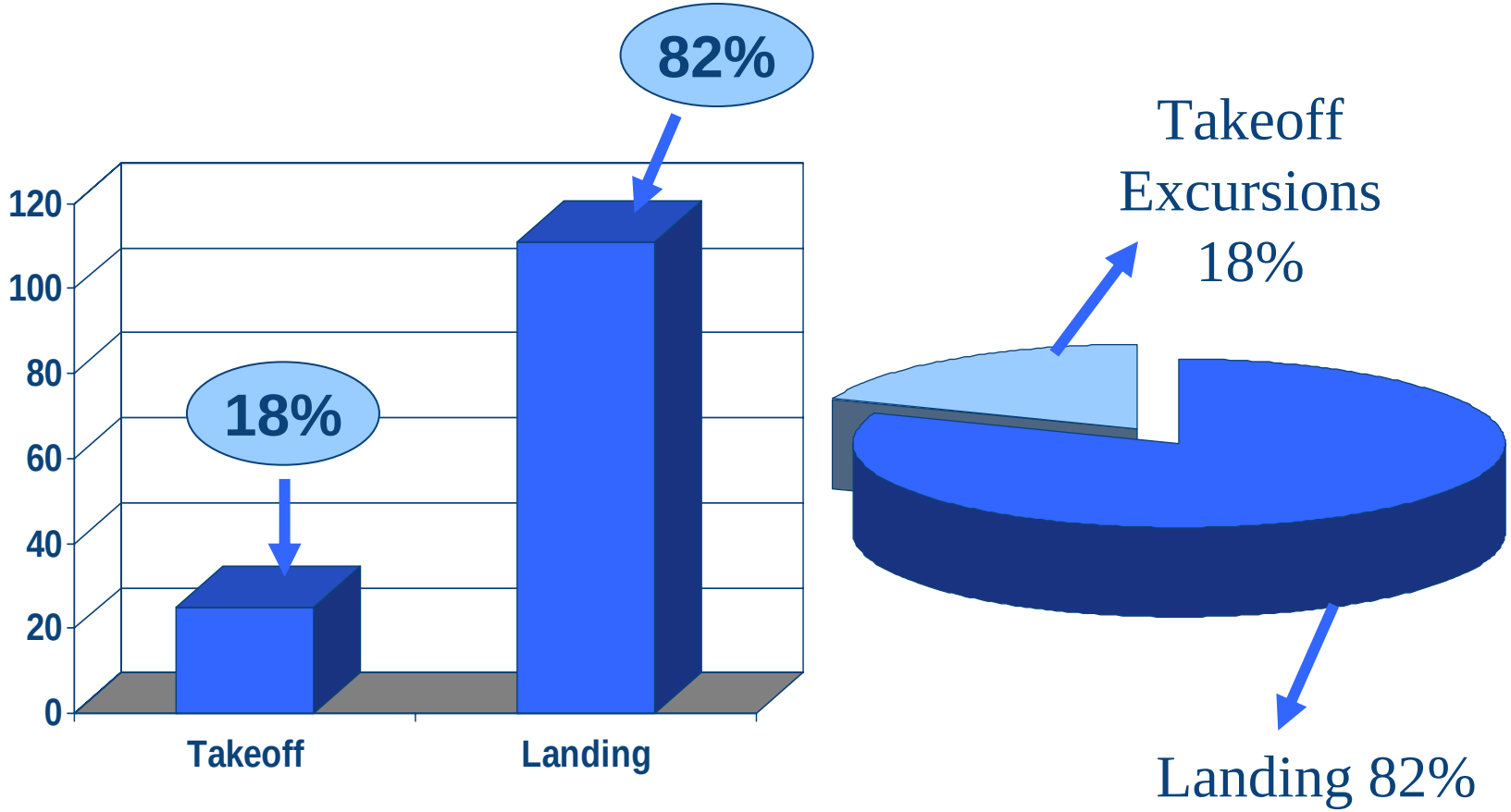

Based on region of operator

# Runway Excursions - Regional Occurrences

## 2004-2008 accident count



# Phase of Flight



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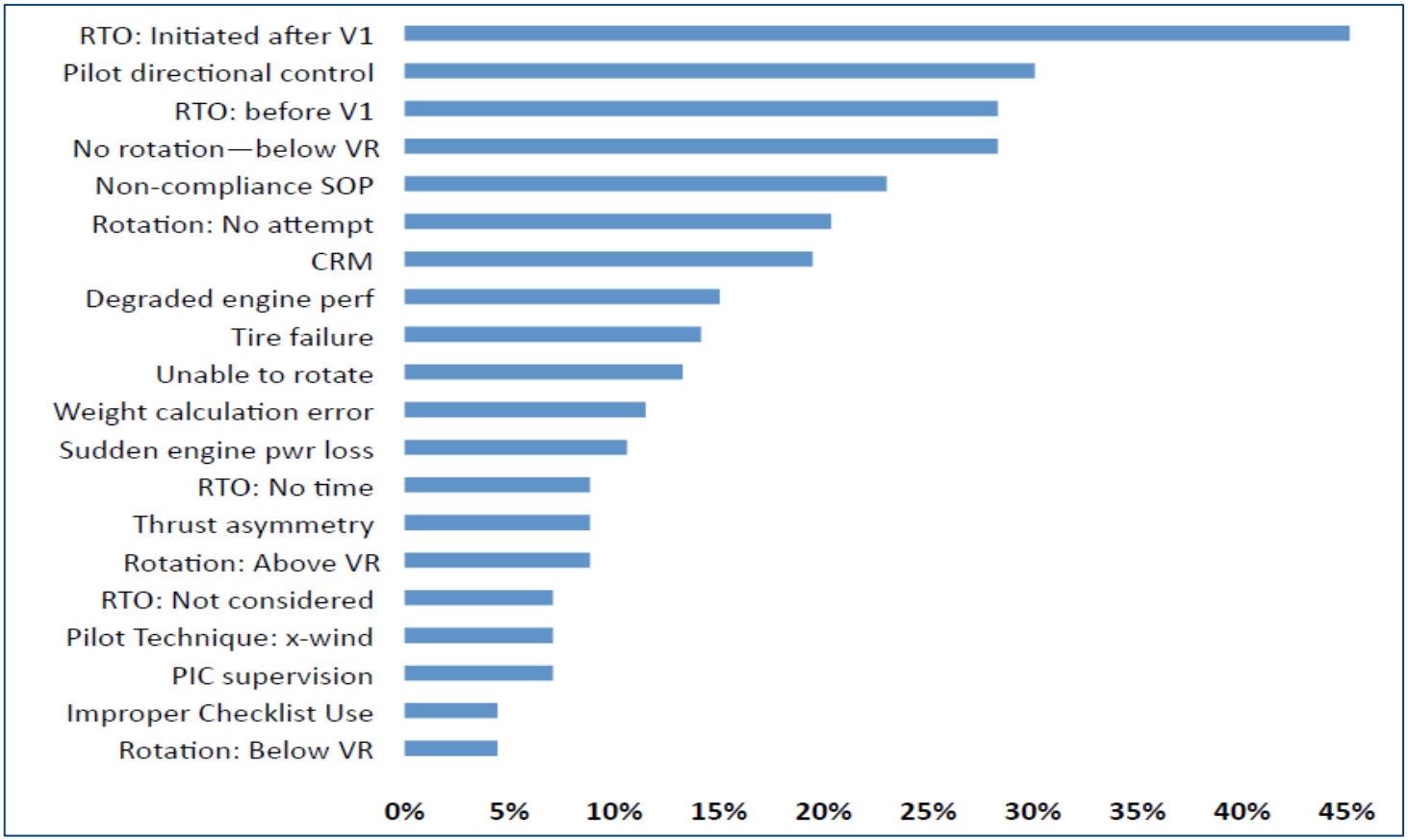
# Takeoff Excursion Risk Factors



# Primary Takeoff Threats

- Inaccurate takeoff and landing performance calculations
- Improper Rejected Takeoff (RTO) accomplishment. Go, No/Go Decisions
- Loss of aircraft directional control during takeoff
- Increased risk due to multiple factors

# Inaccurate Takeoff and Landing Performance Calculations

- T/O performance calculation errors can occur anywhere in the performance calculation process
- These errors can result in:
  - Tail strikes
  - An inability to rotate
  - Insufficient runway to takeoff, or perform an RTO
  - Other unsafe conditions
- Note: data entry errors are a common source of error

# Lessons Learned

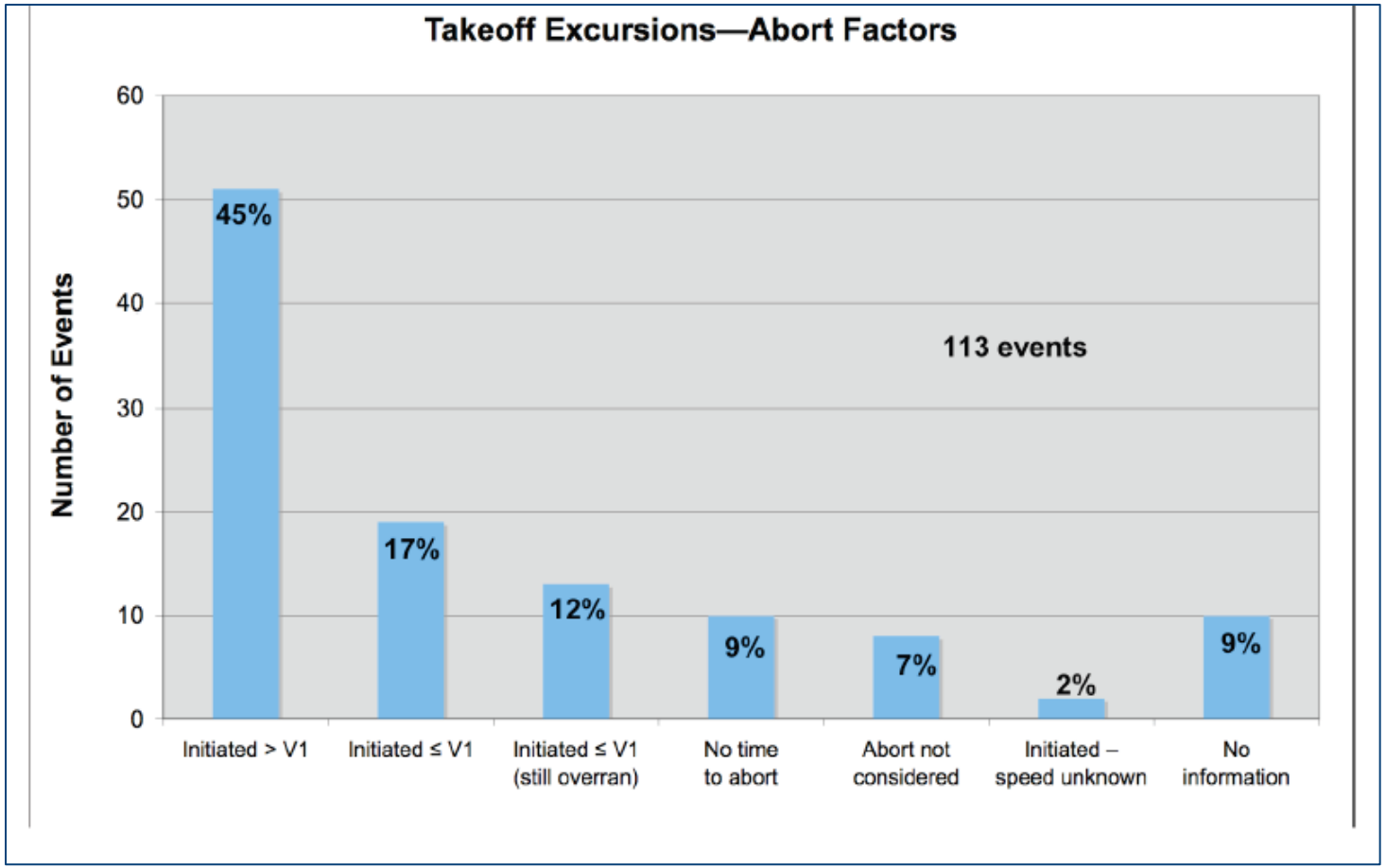
- Always perform a reasonableness check (regardless of the source of the takeoff data)
  - Check the T/O speeds, runway length, thrust setting
- Independently verify the other crew member's actions
- Always follow SOP

# Improper Rejected Takeoff (RTO) Decision

- Go/No-Go decision and $V_1$ speed
  - Initiating RTO above $V_1$ is the number one cause of takeoff excursions

Considerations:

- What does $V_1$ mean?
- What types of events should result in an RTO?
- Who makes the RTO decision and what are the flight crew actions (e.g., CRM)?



# Loss of Aircraft Directional Control during Takeoff or RTO

Consider the following:

- Effects of crosswind and contamination of runway
- Directional control during low speed engine failure
  - Must retard thrust immediately
- Effects of tire failure

# Lessons Learned

- Understand what $V_1$ means, especially regarding RTO capabilities
- Review what types of events should result in RTO
  - Be prepared for engine failures, tire failures, and other mechanical events
- Review RTO procedures during before take-off briefing
- Review the effects of runway condition and wind on directional control

- What is a Runway Excursion
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# Primary Landing Threats

- Un-stabilized approaches
- Failure to make a go-around decision
- Abnormal touchdowns and pilot technique
- Contaminated runways and meteorological factors
- Landing performance calculation errors
- Mechanical malfunctions during landing
- Non-compliance with CRM and SOP

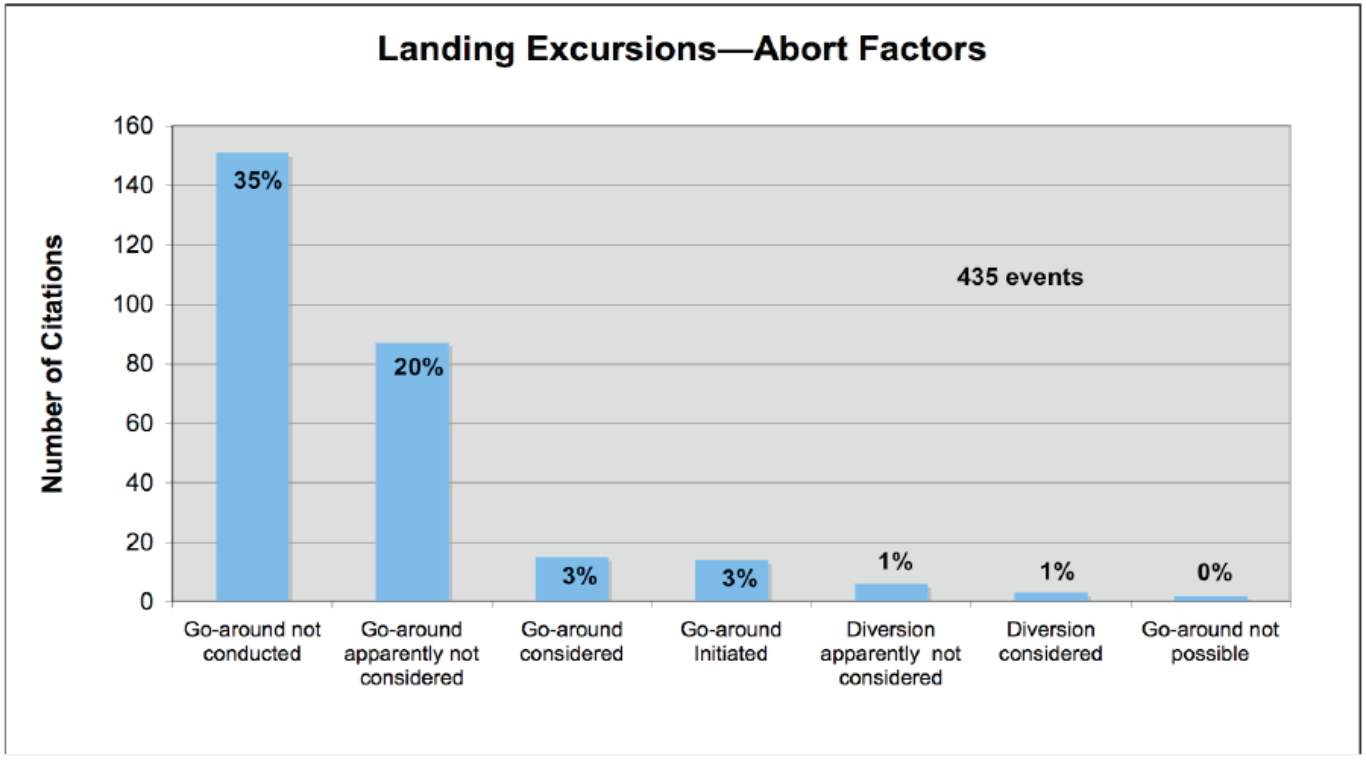
# Un-Stabilized Approaches

- A stable approach is an essential element for a safe landing
- 29% of runway excursions followed an unstable approach
- The typical chain of events includes:
  - A high and fast approach
  - A long/fast touchdown
  - A failure to recognize the need for a go-around

# Failure to Make A Go-Around

- Excessively focused on accomplishing a landing, even with an obviously high or fast approach
- In 35% of landing runway excursions, pilot did not conduct a go-around regardless of existence of strong cues (i.e. assertion from FO, GPWS warning, path deviation, etc)
- In many landing excursions, the pilot did not consider go-around

# Runway Excursion vs Go-Around Decision Data

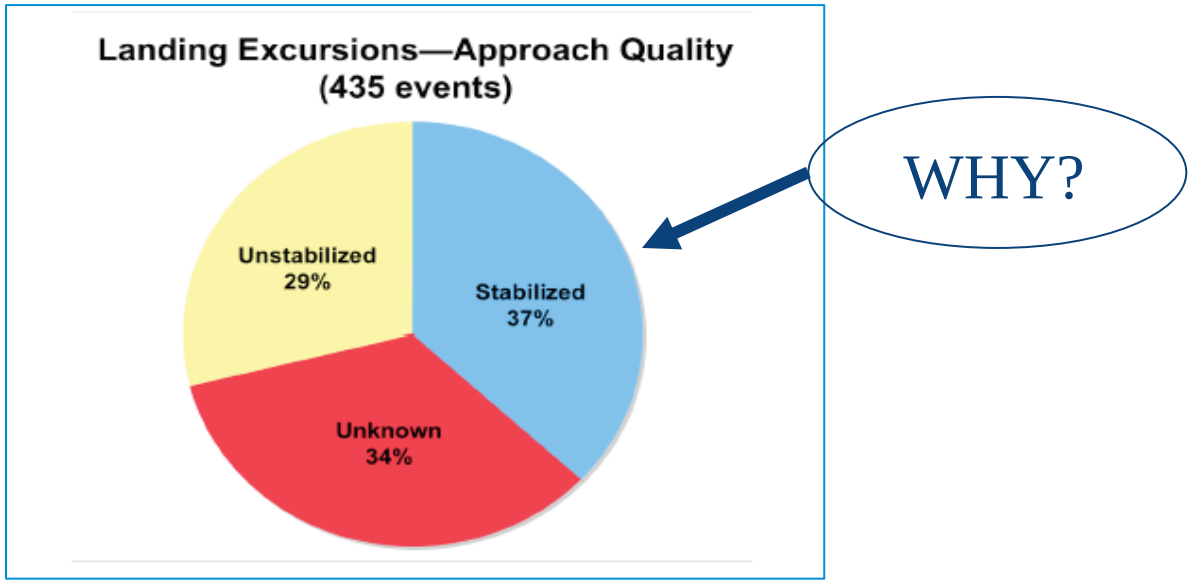


# Lessons learned

- Discuss the threats during the approach briefing
- Go around if you violate stabilized approach criteria
- Comply with company SOP regarding non-flying pilot go-around call outs
- Go-arounds should be considered as an option throughout the approach, flare, and touchdown

# Abnormal Touchdowns and Pilot Technique

- Landings from stabilized approach can still result in a runway excursion



# Abnormal Flare and Touchdowns are Factors in Runway Excursions

- Abnormal touchdowns significantly contribute to the landing excursion accident rate
  - They may occur after a stable or unstable approach
- Meteorological conditions often contribute to significant deviations during landings
  - Comply with the manufacturer's recommended speed adjustments in gusty wind conditions

# Landing Excursion Top Risk Factors

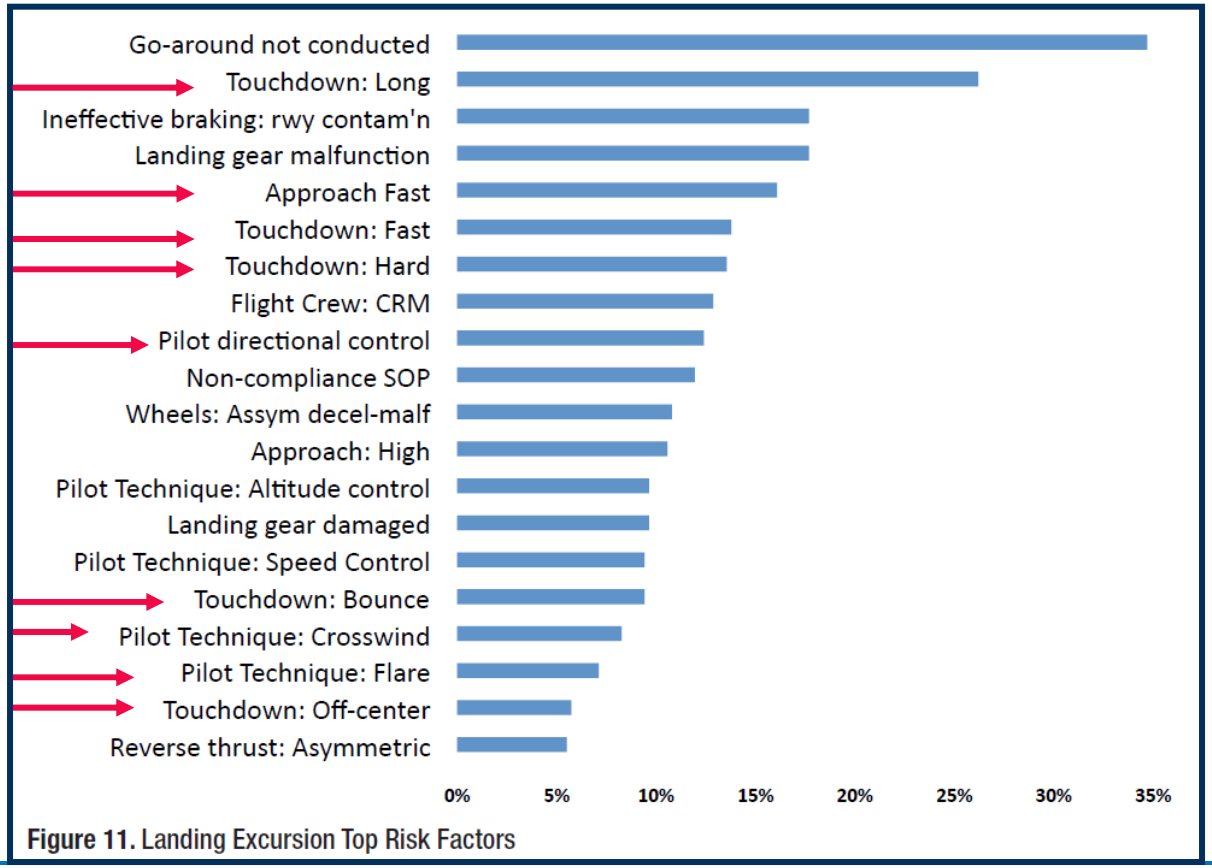



**Figure 11.** Landing Excursion Top Risk Factors

# Lessons Learned

- Select the best runway for the existing conditions
- Optimize the use of aircraft stopping capabilities (i.e., auto brakes, maximum flap settings, auto ground spoilers, etc)
  - Do not delay deceleration on contaminated runways
- Be aware of all factors used in calculating landing performance (i.e, whether reverse thrust is used, etc)
- Brief the threats; in adverse weather or runway conditions, be ready and prepared to make a go-around
- A go-around should be conducted at any time significant deviations are recognized during the flare and touchdown

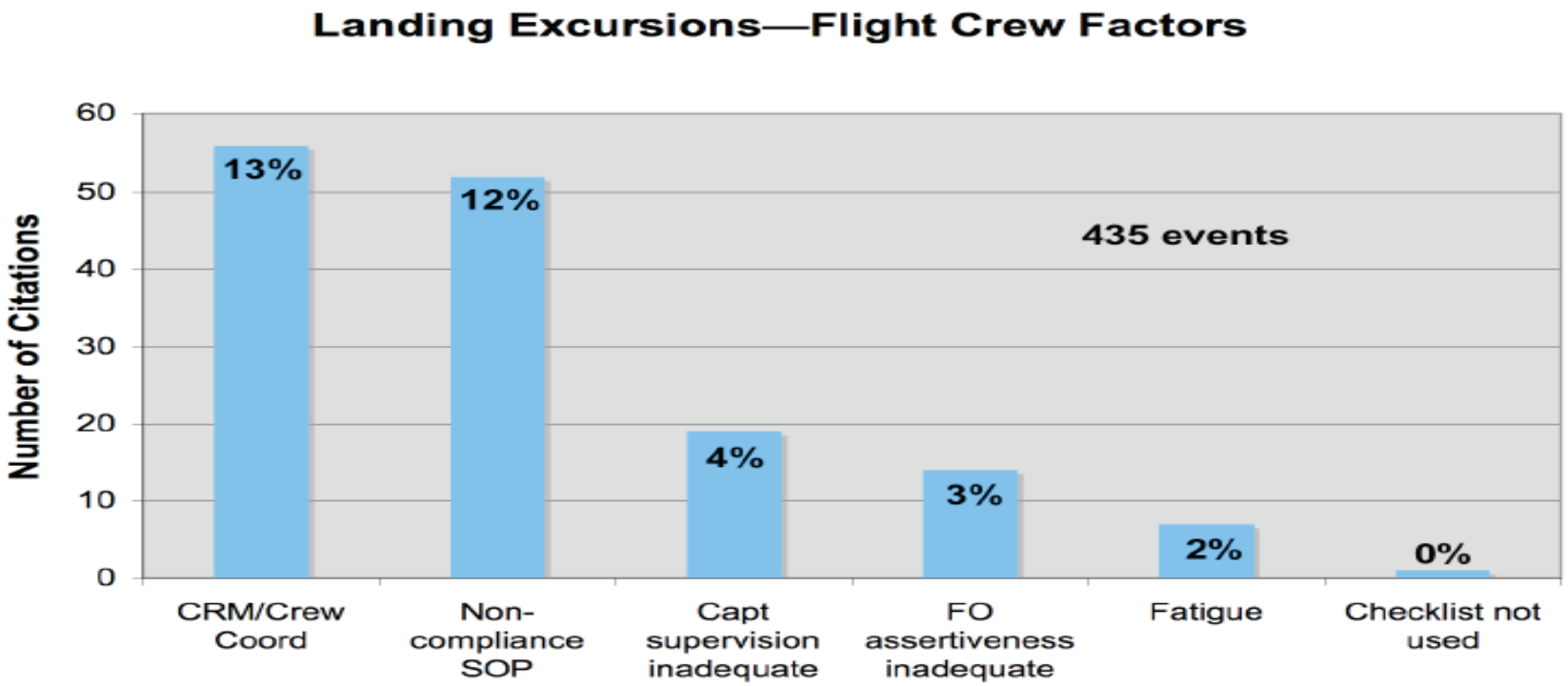
# Contaminated Runway and Meteorological Factors

- Contaminated runway (wet or icy) is a contributing factor in 32% of excursions
- Wind can affect both directional control of the aircraft and deceleration performance
  - Cross winds were present in more than 67% of the landing excursions
  - Steady tailwinds occurred in more than 50% of all accidents
- The combination of a contaminated runway and a tailwind or crosswind is a major contributing factor in accidents

# Mechanical Malfunctions During Landing (Engine Reverser, Brakes)

- Flight crew needs to be ready for malfunctions
- Asymmetrical reverse may result in directional control difficulties
- Improper use of reverse system (i.e. late deployment, or cycling of reversers) is a factor in 6% of accidents
- Landing performance calculations should consider the loss of engine reverse during landing (especially on contaminated runways)
  - During contaminated runway landings, use maximum reverse thrust, combined with wheel brakes, until at a safe taxi speed. A contaminated runway may result in the same effect as a wheel brake mechanical failure.

# Non-Compliance with CRM and SOP is a significant factor in excursion accidents



# Lessons Learned

- Be aware of increased risk with crosswinds or tailwinds, especially on contaminated runways
- Be ready always for mechanical malfunctions
- Always follow SOP and exercise good CRM

# Summary

- Runway excursions are approximately 27% of all accidents
- These accidents can be prevented through training, awareness of the threats, and in applying good judgment to reduce the risk

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