

The background is a collage of navigation-related elements. It includes a topographic map with various colored lines and text, a circular compass rose with a grid, and a dark silhouette of a multi-engine aircraft. The word "WELCOME" is prominently displayed in the center.

**WELCOME**

**Capt. Yuri Yomel Estrada Magaña**

# A PILOT PERSPECTIVE ON PBN OPERATIONS

International Federation of Air Line Pilots' Associations



# IFALPA

The Global Voice of Pilots



## HISTORY

MEXICAN REGULATIONS  
INTERNATIONAL SOURCE

BASIC CONCEPTS

## SAFETY

- CFIT
- Unstabilized approach
- Runway overruns

PBN IMPROVING SAFETY

QUESTIONS

# MEXICAN REG. & INT. SOURCE

Doc 8168  
OPS/811



Procedures for  
Air Navigation Services

## Aircraft Operations

Volume I  
Flight Procedures

This edition incorporates all amendments approved by the Council prior to 3 October 2006 and superseded, on 23 November 2006, all previous editions of Doc 8168, Volume I.

Fifth edition — 2006

International Civil Aviation Organization

Doc 9613  
AN/937



## Performance-based Navigation (PBN) Manual

Approved by the Secretary General  
and published under his authority

Third Edition — 2008

International Civil Aviation Organization

CO AV-11/09

DIRECCION GENERAL DE AERONAUTICA CIVIL

CIRCULAR OBLIGATORIA



APROBACIÓN DE AERONAVES Y TRIPULACIÓN PARA REALIZAR OPERACIONES DE VUELO  
MEDIANTE PROCEDIMIENTOS DE NAVEGACIÓN BASADA EN LA PERFORMANCE (PBN)

01 de Abril de 2010

- Notice *CO AV-10/09* - registration of aircraft equipment for implementation of PBN
- Notice *CO AV-11/09* - approval of aircraft and crew to perform flight operations through navigation (PBN) performance-based procedures
- Notice *CO AV-15/10* - application procedures of the global navigation satellite system (GNSS), into the Mexican air space



- ***PANS OPS Doc. 8168***
  - **Part II Flight procedures – RNAV and Satellite-based**
    - **Section 1. General**
      - ☞ **Chapter 1. General information for RNAV systems**
    - **Section 4. Approach procedures with vertical guidance**
      - ☞ **Chapter 1. APV/Baro – VNAV approach procedures**
- ***PBN Manual Doc. 9613***



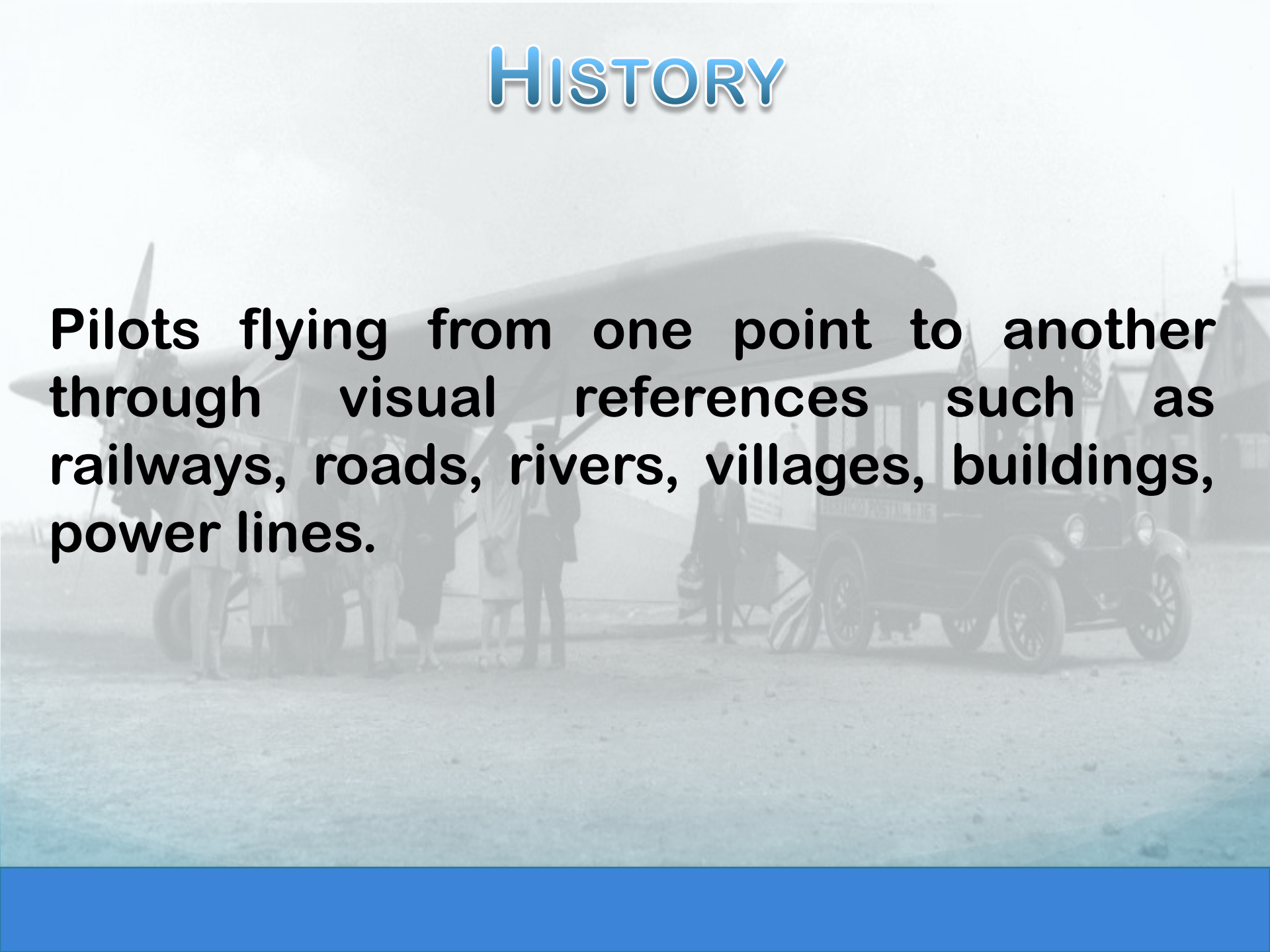
# IFALPA VISION

IFALPA *“Single”* Global Air Navigation System-One set of common Procedures Worldwide.

Recognize that *RNAV* and *RNP* systems considerably increase the safety of our operations, as well as operational advantages over conventional navigation methods.

# HISTORY

**Pilots flying from one point to another through visual references such as railways, roads, rivers, villages, buildings, power lines.**

A faded, historical black and white photograph serves as the background. It depicts an early airplane, possibly a biplane or a small monoplane, parked on a dirt airfield. A group of people, including men and women in early 20th-century attire, are gathered around the aircraft. To the right, a vintage automobile from the 1910s or 20s is parked. The scene is set outdoors, with some buildings visible in the background. The overall image has a light, hazy appearance, making the text overlaid on it stand out.



evolution of the navigation aids needed for the development of VOR and ILS.

**Markers, Beacons, VOR, ILS were developed.**



# PRESENT

A satellite is shown in space, with its solar panels extended. The Earth's surface is visible in the background, showing clouds and the horizon. The satellite has a central body and two large solar panel arrays. The background is a dark space filled with stars.

**Under the concept of PBN, performance requirements change radically**

**Pilots and ATC controllers are the end users of the PBN**

# CONCEPTS

**AIRSPACE**

```
graph TD; AIRSPACE[AIRSPACE] --- COM[COM]; AIRSPACE --- SURV[SURV]; AIRSPACE --- ATM[ATM]; AIRSPACE --- PBN[PBN];
```

**COM**

**SURV**

**ATM**

**PBN**

# PBN

```
graph TD; PBN --> NS[NAVIGATION SPECIFICATIONS]; PBN --> NI[NAVIGATION INFRASTRUCTURE];
```

**NAVIGATION  
SPECIFICATIONS**

**(Set of aircraft and  
aircrew requirements)**

**NAVIGATION  
INFRASTRUCTURE**

**(Earth/space Based)**

# NAVIGATION SPECIFICATIONS

```
graph TD; A[NAVIGATION SPECIFICATIONS] --> B[RNAV]; A --> C[RNP]; B --- D[No Monitoring/Alert requirement]; C --- E[Monitoring/Alert requirement]
```

**RNAV**

**No Monitoring/Alert  
requirement**

**RNP**

**Monitoring/Alert  
requirement**

# DESIGNATION OF NAVIGATION SPECIFICATIONS

RNAV 10

RNP 4

RNAV X

RNP X

THE NAVIGATION ACCURACY



# ONBOARD PERFORMANCE MONITORING AND ALERTING

**RNAV**



**ONBOARD PERFORMANCE  
MONITORING AND ALERTING**



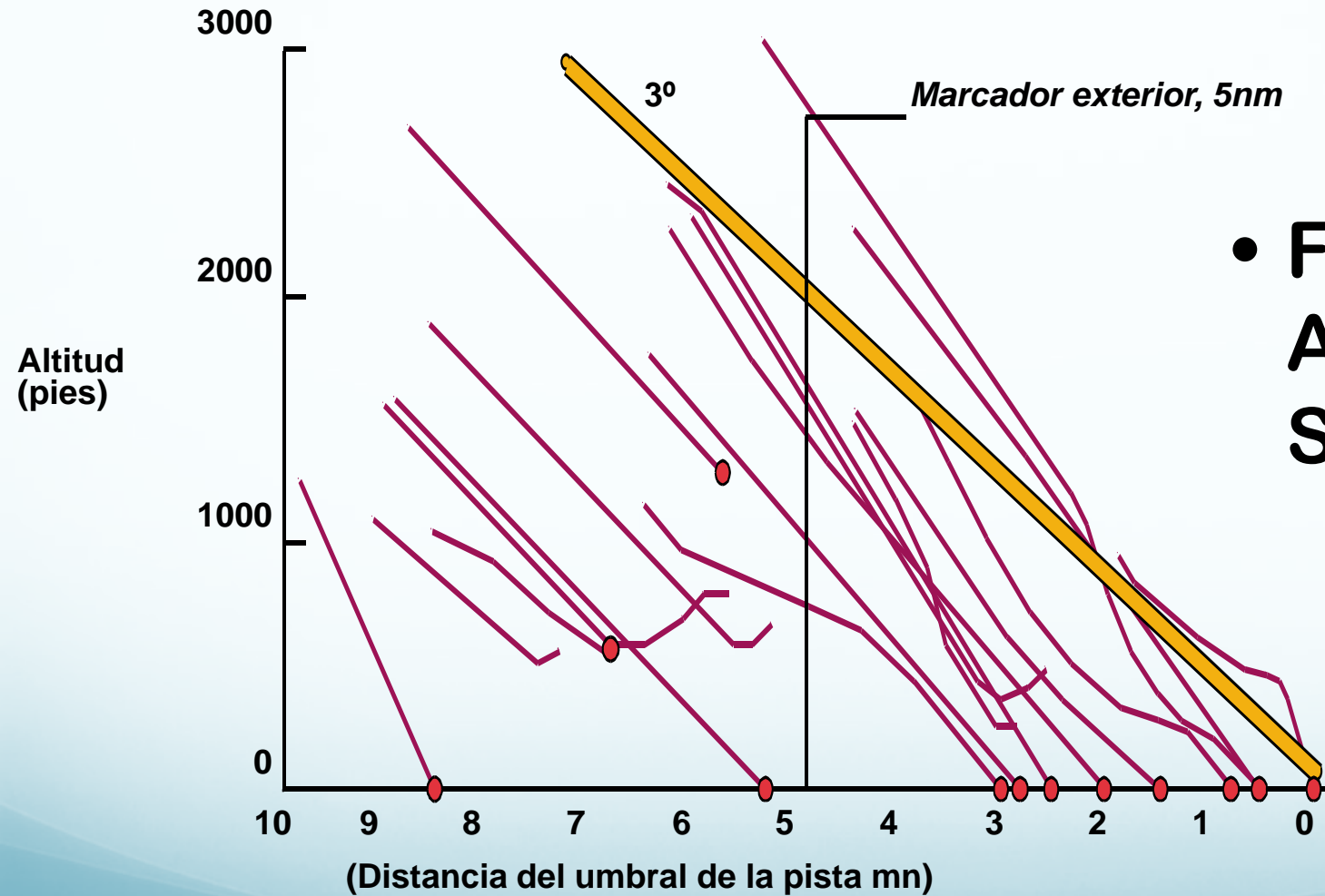
# SAFETY

**A hull loss is 8 times more likely to occur during a non - precision approach, than during a PBN approach  
-ICAO-**

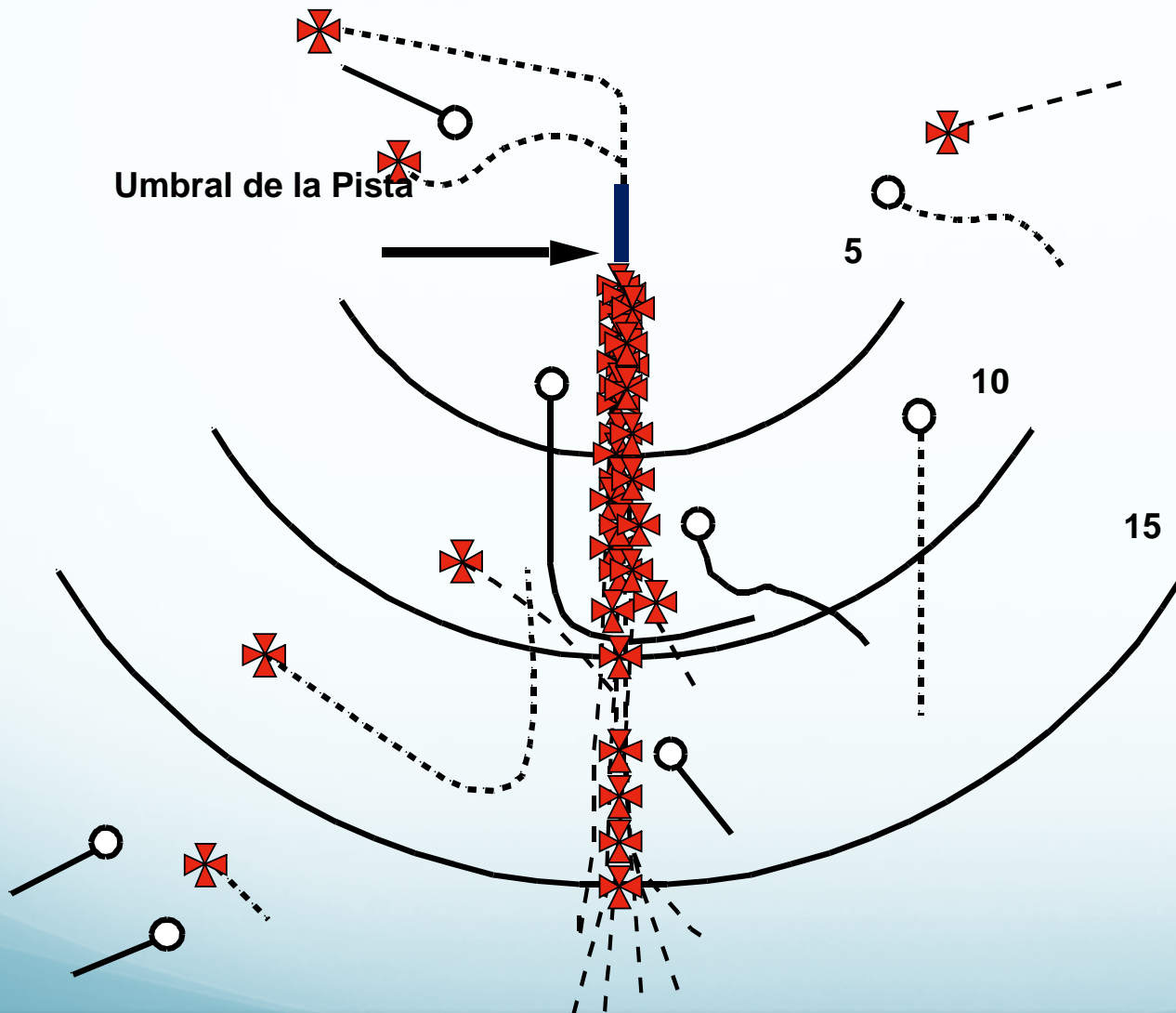
# CFIT

**The controlled flight into terrain (CFIT) occurs when an aircraft in conditions of airworthiness and crew control is inadvertently flown against the terrain, obstacles, or water, usually without awareness of the crew.**

- > 60% within 8NM



- Final Approach Segment

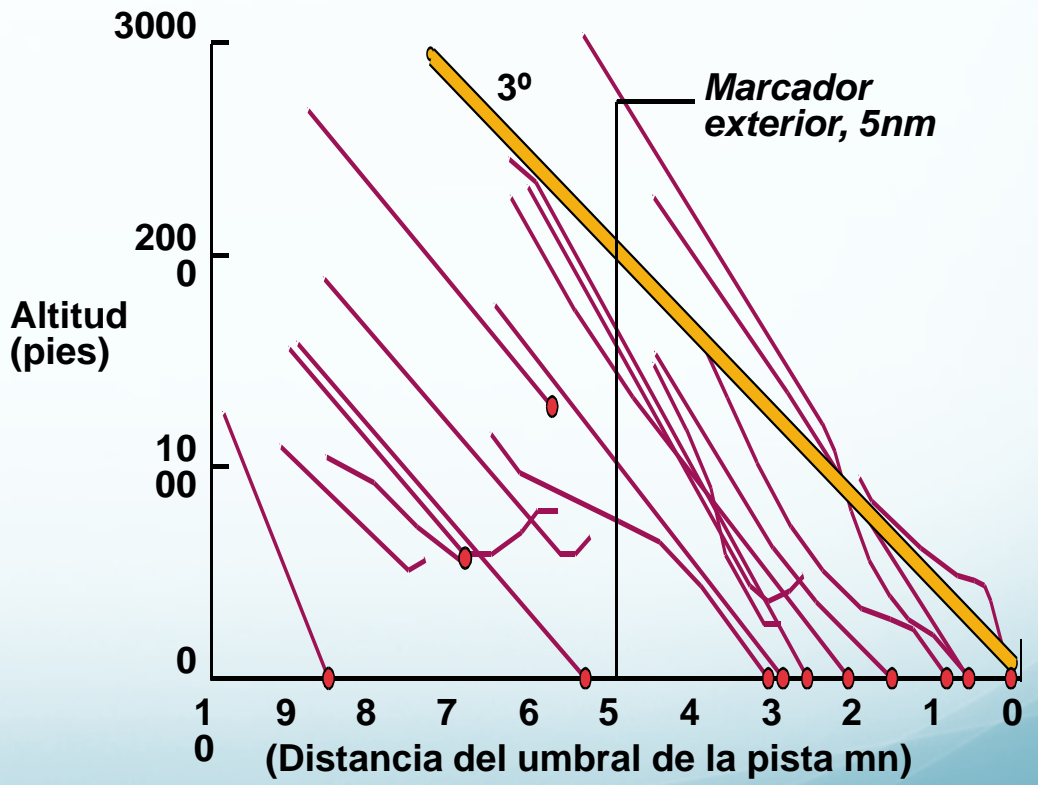
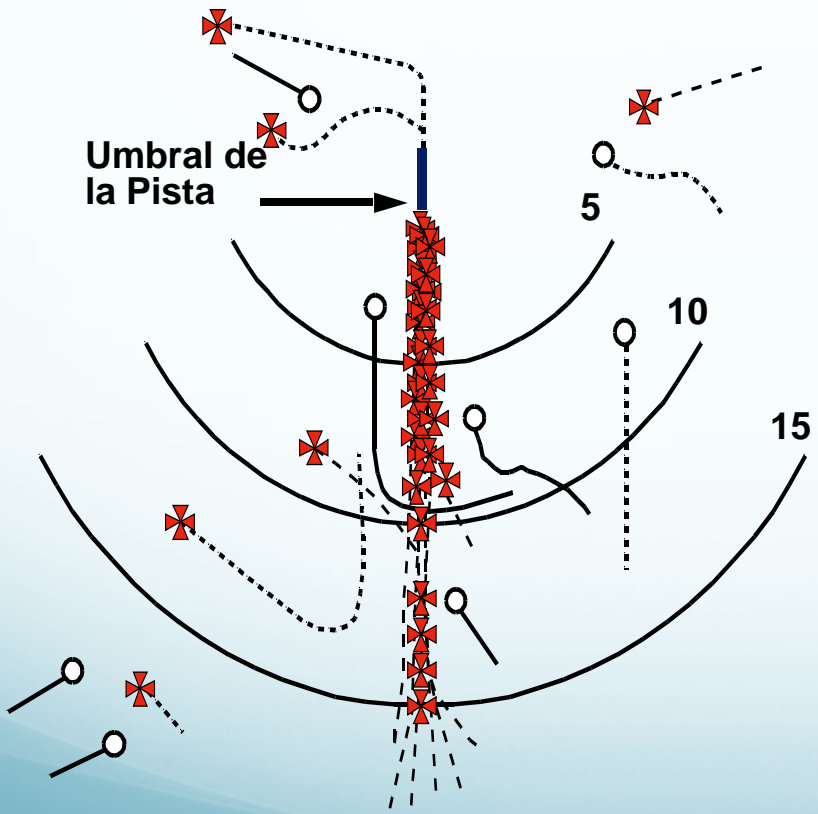


- **> 60% within 8NM**

- **Final Approach Segment**

- **Lateral tracking not the cause**

- The *Vertical* trajectory is the determining factor.



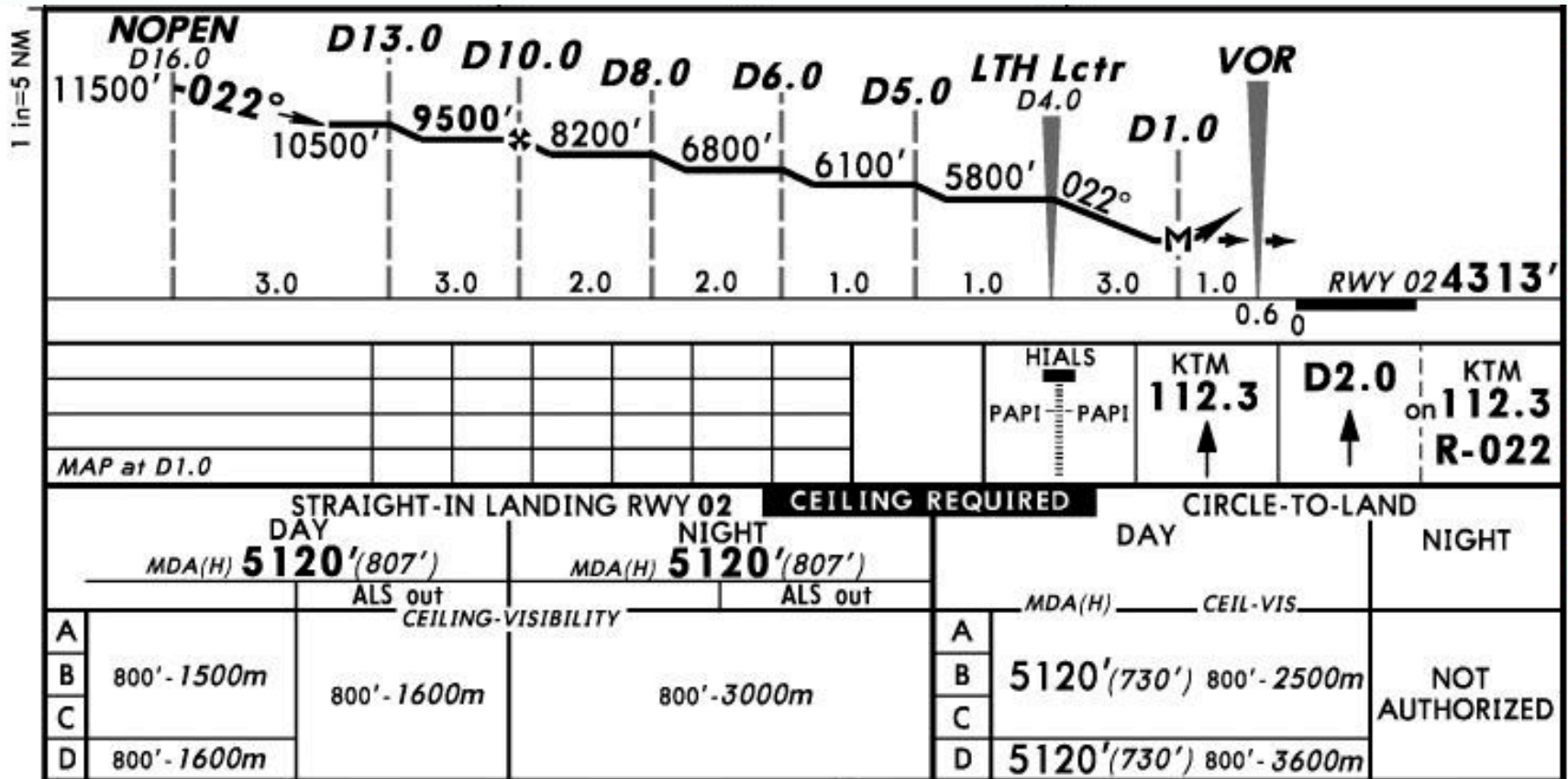


# CONTRIBUTING FACTORS

- Loss of vertical situational awareness
- The approach contains multiple altitude steps from the IAF - FAF
- The airplane wasn't in the correct path of flight
- Non – precision approaches (No vertical guidance *APV*)

# Conventional approach

## VOR



# UNSTABILIZED APPROACH

The non-stabilized approaches were in some cases contributor factors in **CFIT** accidents since the aircraft was not stabilized 1000 feet above airport elevation in “IMC” and 500 feet above airport elevation in “VMC”.

# **RUNWAY OVERRUNS**

An aerial photograph of an airport runway. The runway is a long, straight strip of asphalt with white markings. In the foreground, a large white commercial airplane is parked on the tarmac. The background shows green grass and some airport buildings. The overall scene is slightly hazy.

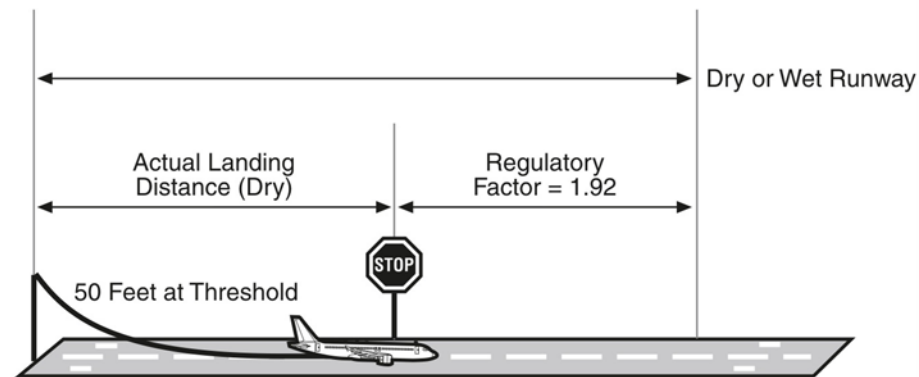
**Likewise, the non-stabilized approaches were a contributing factor in accidents related to runway overruns.**

**A runway overruns occurs when the aircraft roll-out extends beyond the end of the landing runway.**

# FACTORS INVOLVED

- Unstable approach path (steep and fast)
- Landing fast; and,
- Excessive height over threshold, resulting in landing long

## Required Runway Length — U.K. CAA



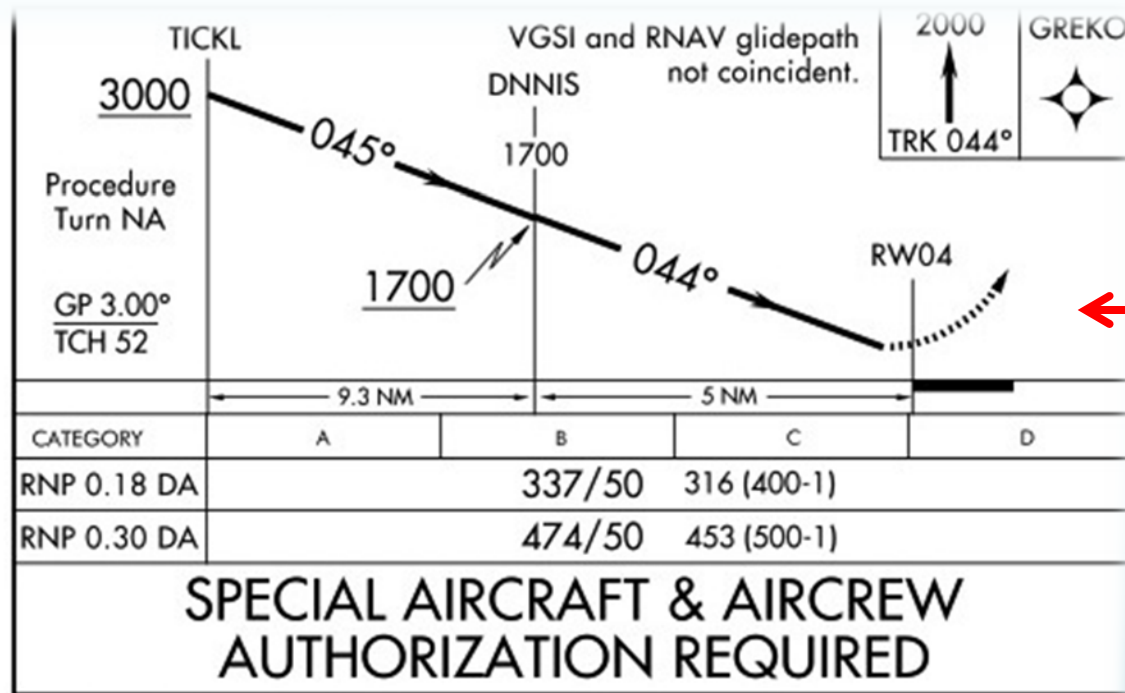
Required runway length (dry or wet) = Actual landing distance (dry) x 1.92

CAA = Civil Aviation Authority

Source: Flight Safety Foundation Approach-and-landing Accident Reduction (ALAR) Task Force

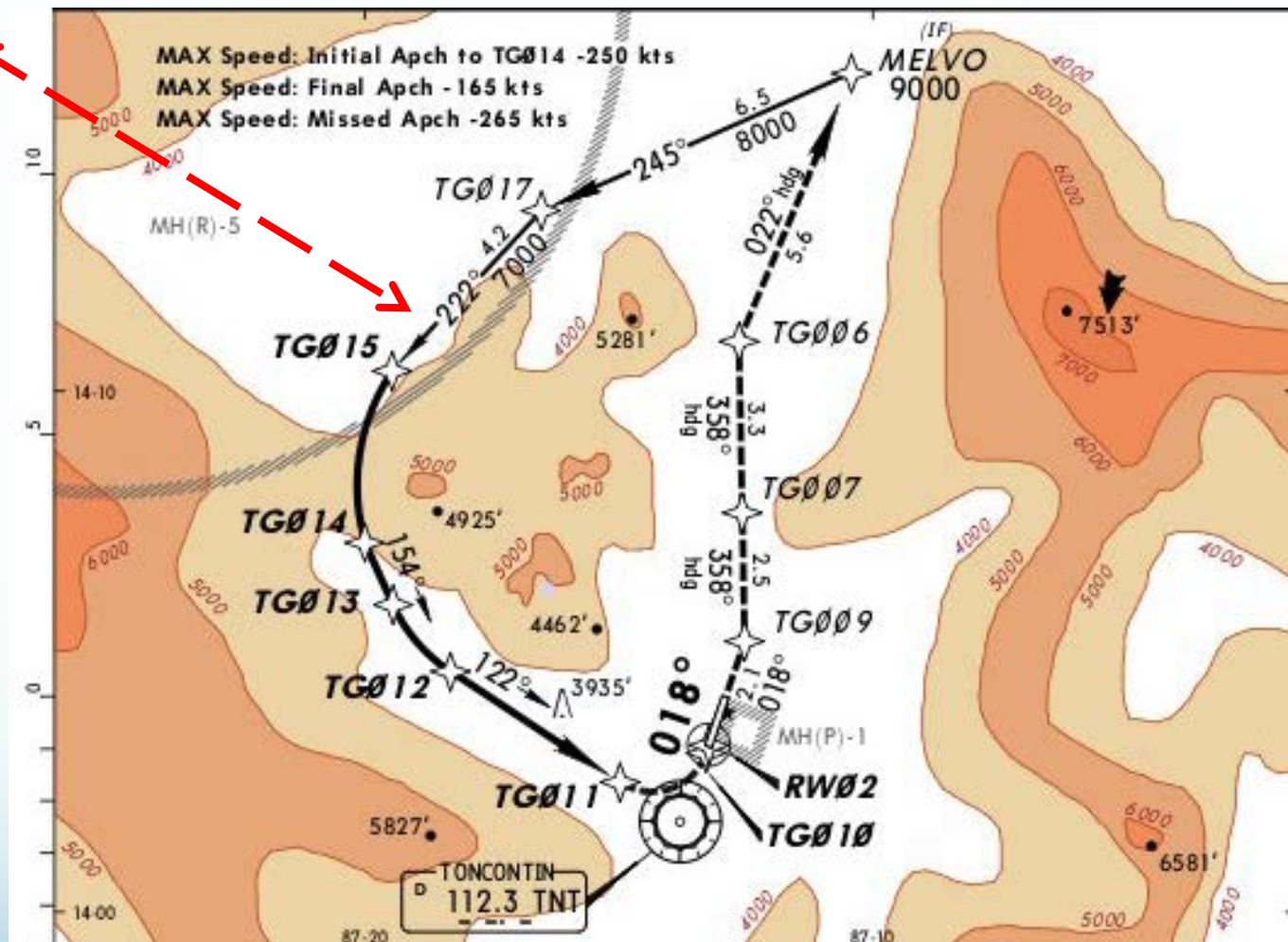
# PBN IMPROVING SAFETY

It reduces the risk of CFIT accident, since it provides a very accurate vertical flight path.



NEW YORK, NEW YORK

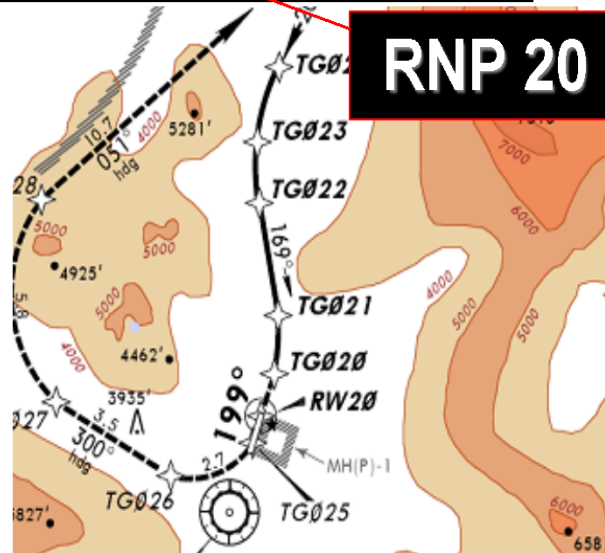
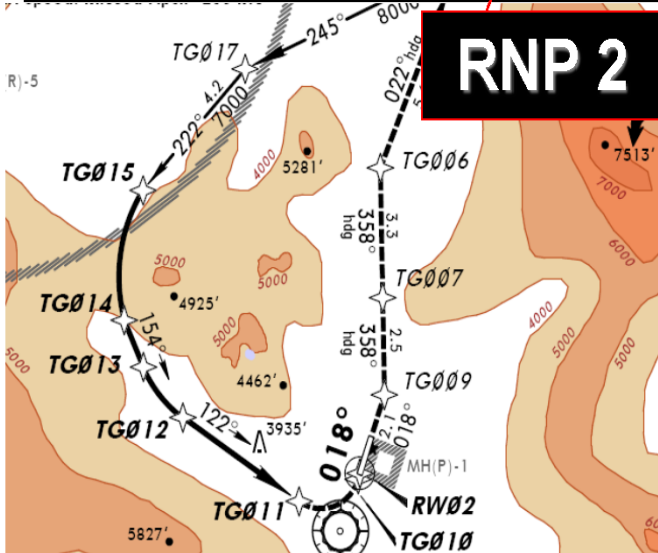
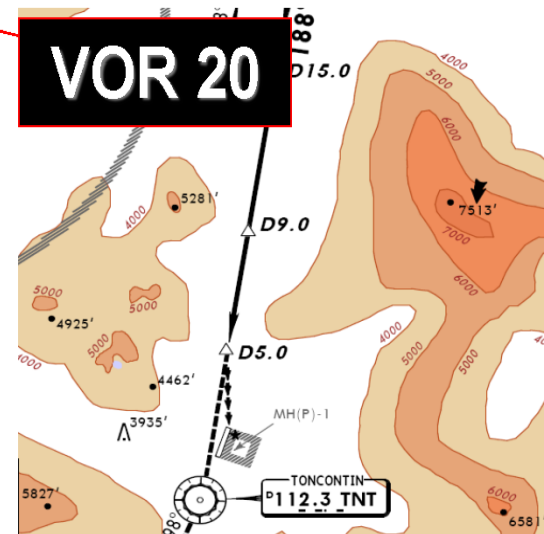
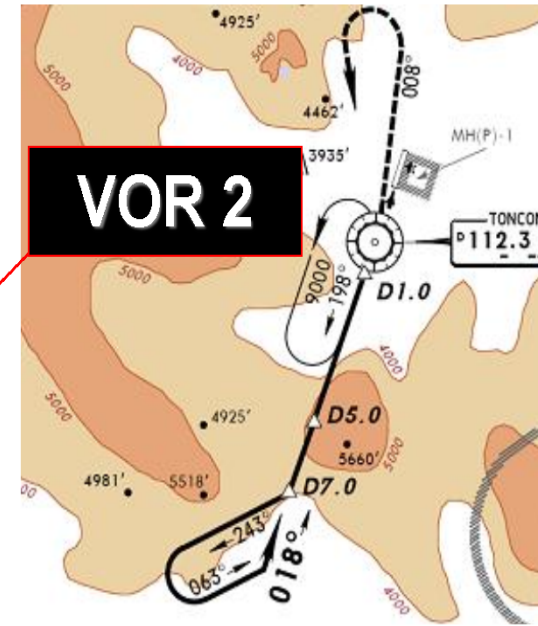
It reduces the risk of CFIT accident, since it provides a very precise lateral flight path.



**Provides stabilized approaches, since the aircraft track is aligned with the center of the runway, in the same configuration, with the same speed every time, which guarantees that it crosses the threshold of the runway at 50 feet, improving the safety and reducing runway overrun.**

# APPROACH MINIMA BEFORE RNAV (RNP)

	Approach Minima	
	RNP	VOR
Runway 2	847'	2,333'
Runway 20	433'	2,703'



# **¡ THANK YOU!**

## **Capt. Yuri Yomel Estrada Magaña**



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