



GRF – Operational Need

Relevance to Aeroplane Performance

Logan JONES – Runway Safety at NAVBLUE
ICAO Global Reporting Format Regional Seminar – Lima Peru



AIRBUS

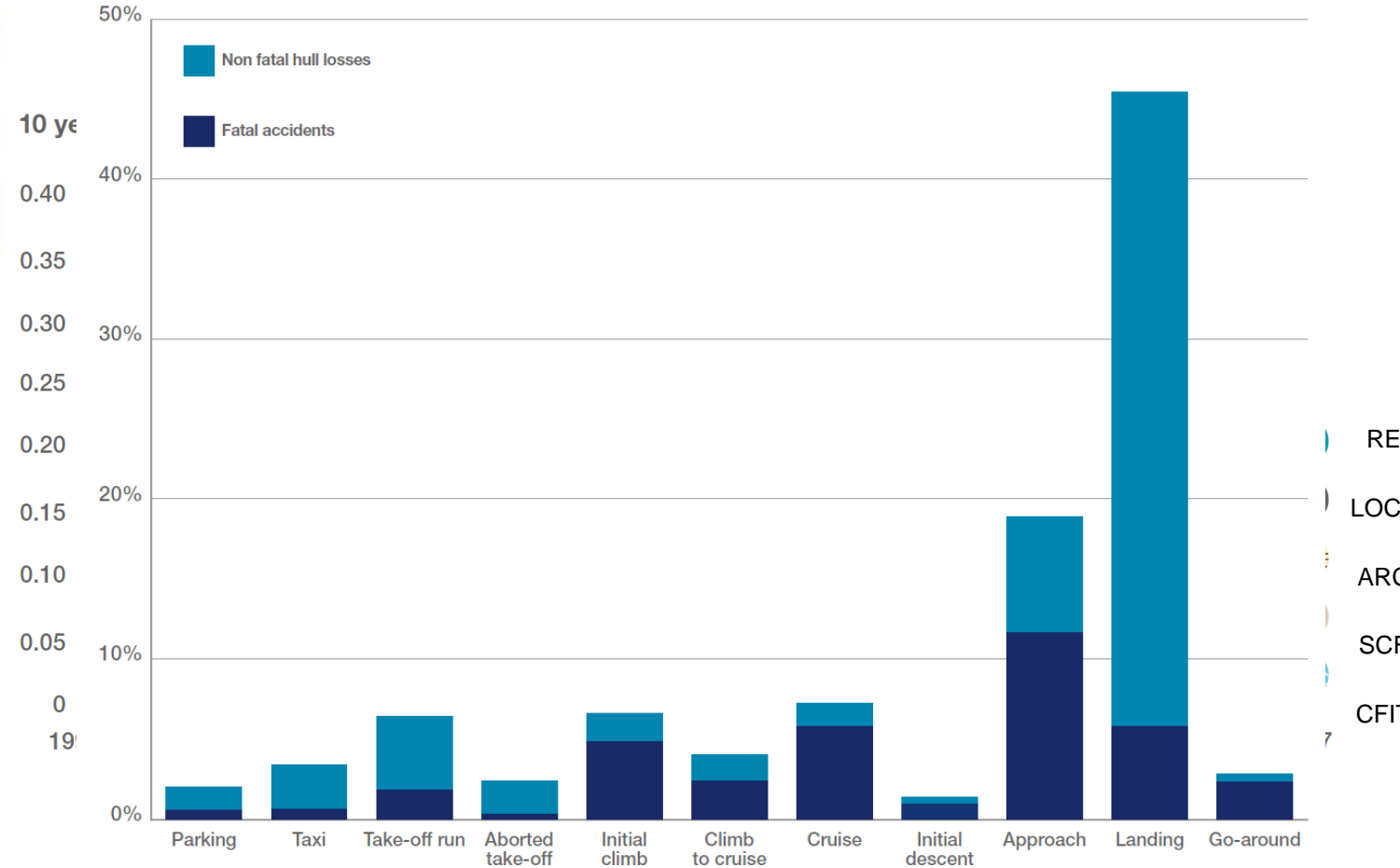


Background

A statistical Analysis of Commercial Aviation Accidents 1958-2016



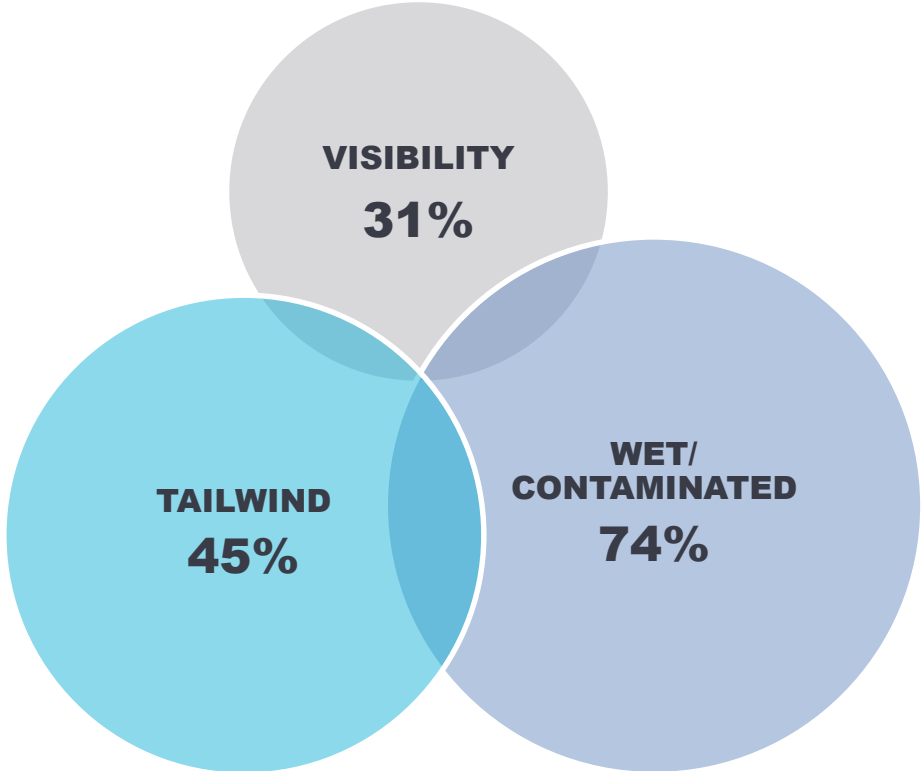
Accidents by flight phase as a percentage of all accidents 1997-2016



Focus on Runway Overruns

Reported events on Airbus aircraft since 2005

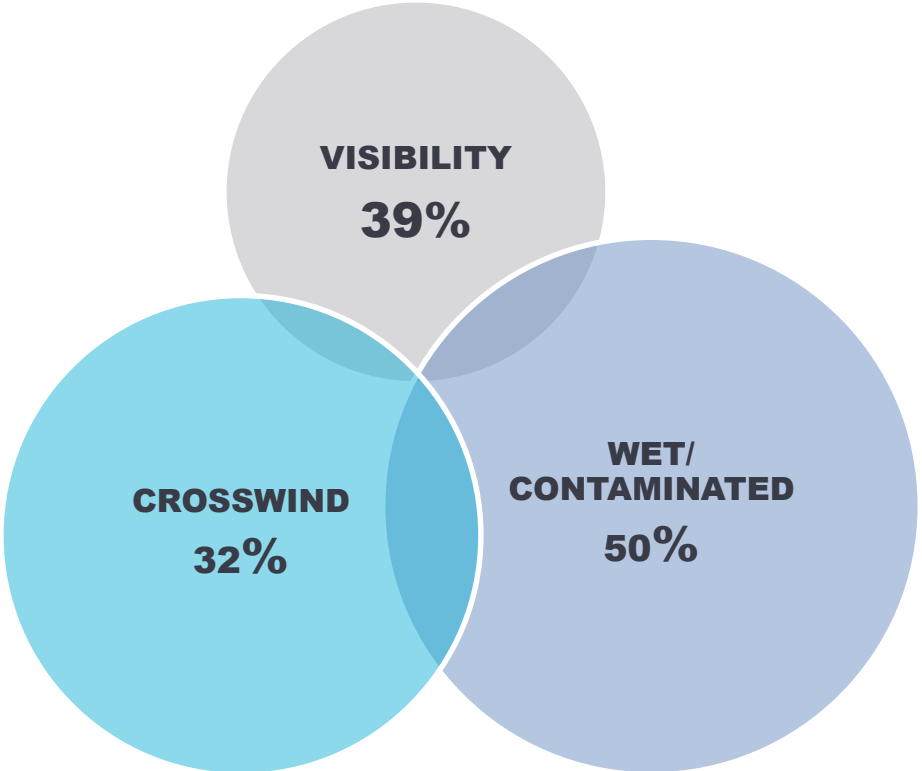
- Average of 3 events per year
- 80% of events with weather as contributor



Focus on Runway Veeroffs

Reported events on Airbus aircraft since 2005

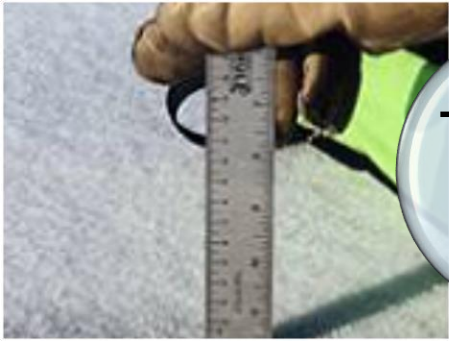
- Average of 7 events per year
- 75% of events with weather as contributor



Effect of Runway Condition on Aircraft Performance



Reporting in the Past



Type & Depth



Friction Vehicle



Airman Report

Different terminology

Different contaminant types

Insufficient depth accuracy

No correlation with A/C performance

Not up to date

Not objective

Difficult to translate from reported to aircraft performance



Perfo.



Def.



Proc.

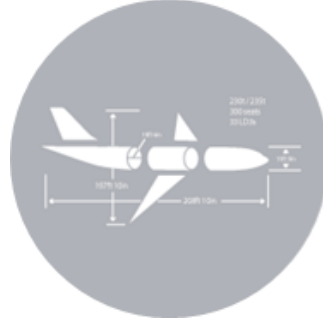


ICAO Global Report Format and Runway Condition Assessment Matrix

End to End System



Aerodromes



Manufacturers



Operators

Common Language

Contaminant Types

Runway Condition Codes

Direct Input to Performance Assessment

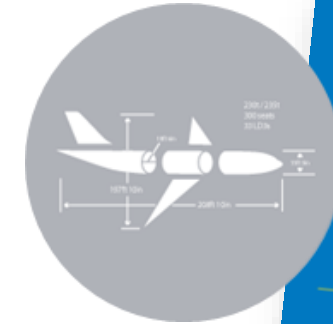
Performance Relevance

Depth Thresholds & Temperatures

Significant Changes

Airworthiness – Annex 8

- Option for takeoff performance on contaminated runway
- Mandate split of landing performance information into
 - At Time of Takeoff data (dispatch)
 - At Time of Landing data (in-flight)
- New At Time of Landing Distances shall reflect real operating practices
- Both types of landing distances may be provided for contaminated runways



Operations - Annex 6



- For large and small airplanes
- Mandate AIREP when conditions worse than reported
- Mandate in-flight check with appropriate margin before starting approach

RCAM Elements

RWYCC

Coverage

Depth

OAT

Contaminants

Runway condition assessment matrix (RCAM)			
Assessment criteria		Downgrade assessment criteria	
Runway condition code	Runway surface description	Aeroplane deceleration or directional control observation	Pilot report of runway braking action
6	<ul style="list-style-type: none"> • DRY 	---	---
5	<ul style="list-style-type: none"> • FROST • WET (The runway surface is covered by any visible dampness or water less than 3 mm deep) <p>Less than 3 mm depth:</p> <ul style="list-style-type: none"> • SLUSH • DRY SNOW • WET SNOW 	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	GOOD
4	<p>-15°C and Lower outside air temperature:</p> <ul style="list-style-type: none"> • COMPACTED SNOW 	Braking deceleration OR directional control is between Good and Medium.	GOOD TO MEDIUM
3	<ul style="list-style-type: none"> • WET ("Slippery wet" runway) • DRY SNOW or WET SNOW (Any depth) ON TOP OF COMPACTED SNOW <p>3 mm and more depth:</p> <ul style="list-style-type: none"> • DRY SNOW 	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is	MEDIUM

"Other" Observations

AIREPs

Measured Friction

Reportable Contaminants

COMPACTED SNOW
DRY SNOW
DRY SNOW ON TOP OF COMPACTED SNOW
DRY SNOW ON TOP OF ICE
FROST
ICE
SLUSH
STANDING WATER
WATER ON TOP OF COMPACTED SNOW
WET
WET ICE

WET SNOW
WET SNOW ON TOP OF COMPACTED SNOW
WET SNOW ON TOP OF ICE

CHEMICALLY TREATED
LOOSE SAND

Situational Awareness

MUD
DUST
SAND
VOLCANIC ASH
OIL
RUBBER

Not in the RCAM

- RCAM covers only conditions with **deterministic** performance effect
- Other conditions (sanding/chemicals) addressed by down-/upgrade mechanism
 - Driven by Mu / Other observations / AIREPs

Depth

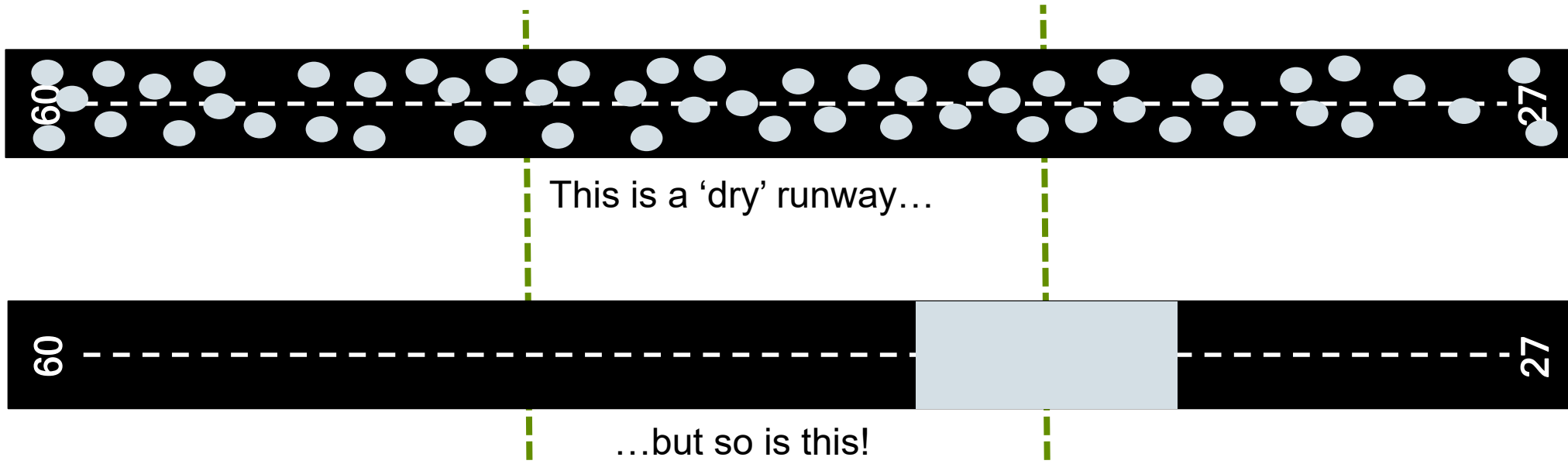
- Any fluid contaminant below 3mm = **WET**
 - Well constructed and maintained pavement allows tire to drain fluid from footprint and maintain contact with runway – **NO** dynamic **AQUAPLANING**
- Any fluid contaminant above 3mm = **CONTAMINATED**
 - **AQUAPLANING** occurs above aquaplaning speed

- **Dry Snow and Wet Snow are not fluids**
 - Same 3mm depth threshold
 - Below 3mm loose contaminant is compressed into macrotexture allowing contact of tire and runway surface
 - **Caution** - Some evidence shows that conditions may become slippery even below 3mm



Coverage

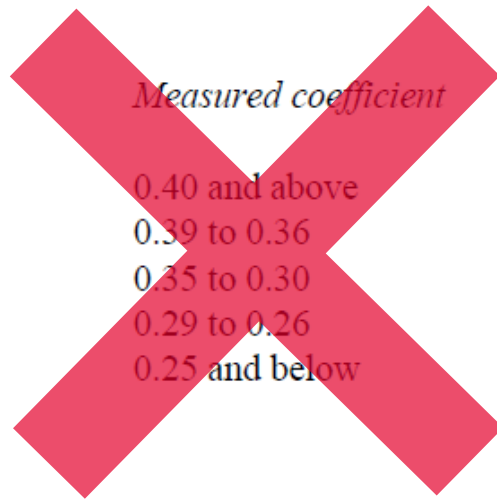
- Coverage reported for each third
- Coverage reported as 25% above 10% observed coverage
- Contaminated in terms of performance above 25% coverage



- It has been demonstrated that, if performance calculated for dry condition, regulatory/recommended margins cover concentration of contaminant in worst location

Measured Friction

- ICAO provides no friction scale due to poor correlation with aircraft braking action
- CFME used is based on a method approved by the State



Measured coefficient

0.40 and above
 0.39 to 0.36
 0.35 to 0.30
 0.29 to 0.26
 0.25 and below

Estimated braking action

Good
 Medium to good
 Medium
 Medium to poor
 Poor

Code



5
 4
 3
 2
 1



- Used basically for **downgrade**
- **Upgrade** only with significant margins

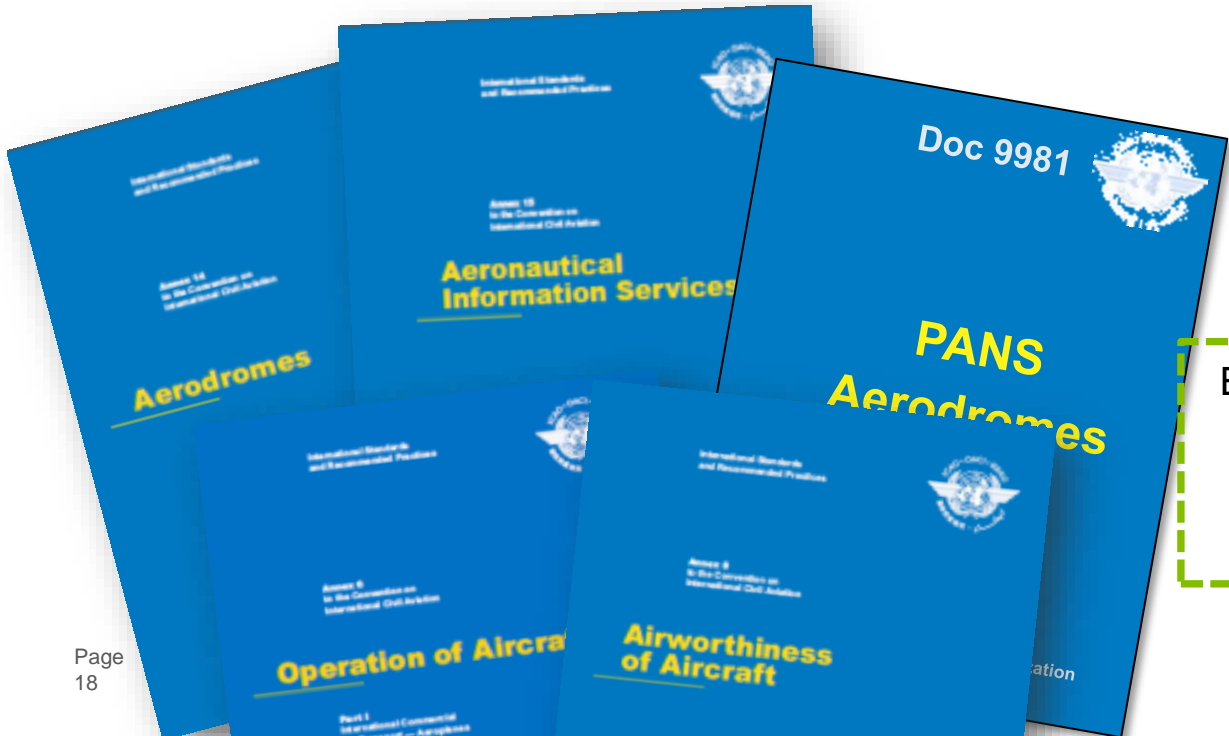
Differences with Aircraft

Tire Size
 Tire Load
Tire Press
 Speed
 Slip Ratio
 Drag

A) ENNK S  AM
 B) 11 JAN 2013 04:43
 C) 01 F) 379/379/379 G) XX/XX/XX H) 3/4/4
 N) C/CLSD ALL REMAINING TWYS/379
 R) APRON B/CLSD ALL REMAINING APRONS/379
 T) CONTAMINATION/100/100/100/PERCENT. SAND APPLIED.
 UUEE 050230Z 17004MPS 0900 R25R/P1500U +SHSN VV004
 M01/M01 Q1017 **75590230 25590230**
METAR M 

Landing Performance Level
 Direct input into At Time of Arrival Assessment

Runway Surface Conditions	Runway Friction	Runway Surface Condition	Runway Condition	Runway Condition	Runway Condition
Asphalt	0.15	0.15	0.15	0.15	0.15
Concrete	0.15	0.15	0.15	0.15	0.15
Gravel	0.15	0.15	0.15	0.15	0.15
Grass	0.15	0.15	0.15	0.15	0.15
Water	0.15	0.15	0.15	0.15	0.15
Snow	0.15	0.15	0.15	0.15	0.15
Ice	0.15	0.15	0.15	0.15	0.15
Other	0.15	0.15	0.15	0.15	0.15

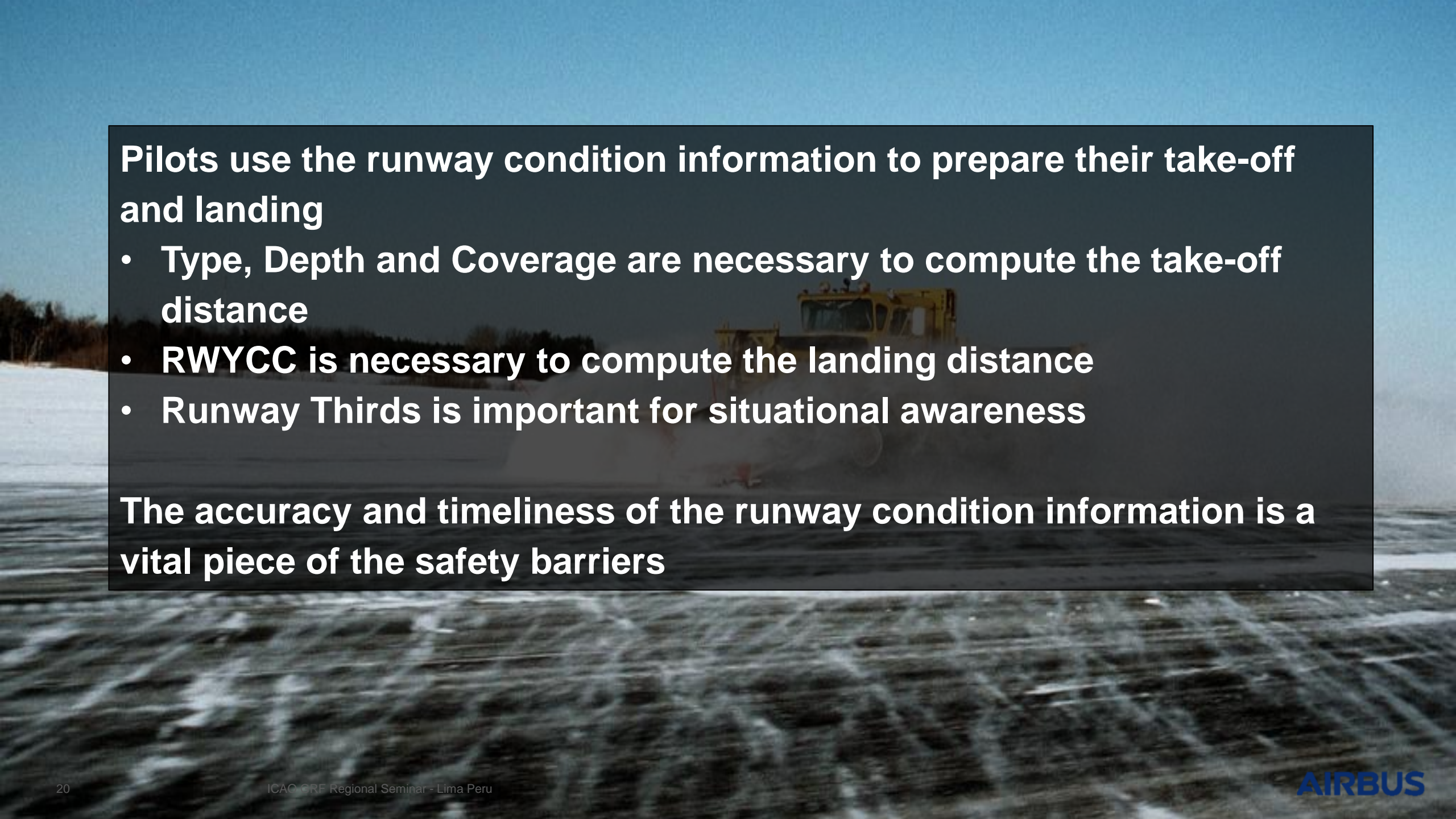


ENCN 09111400 09L **3/3/2** 25/50/50 05/05/02 DRY SNOW/WET
 SNOW/WET SNOW 30.
 DRIFTING SNOW. RWY 09L CHEMICALLY TREATED. TWY B
 POOR





Operational Use

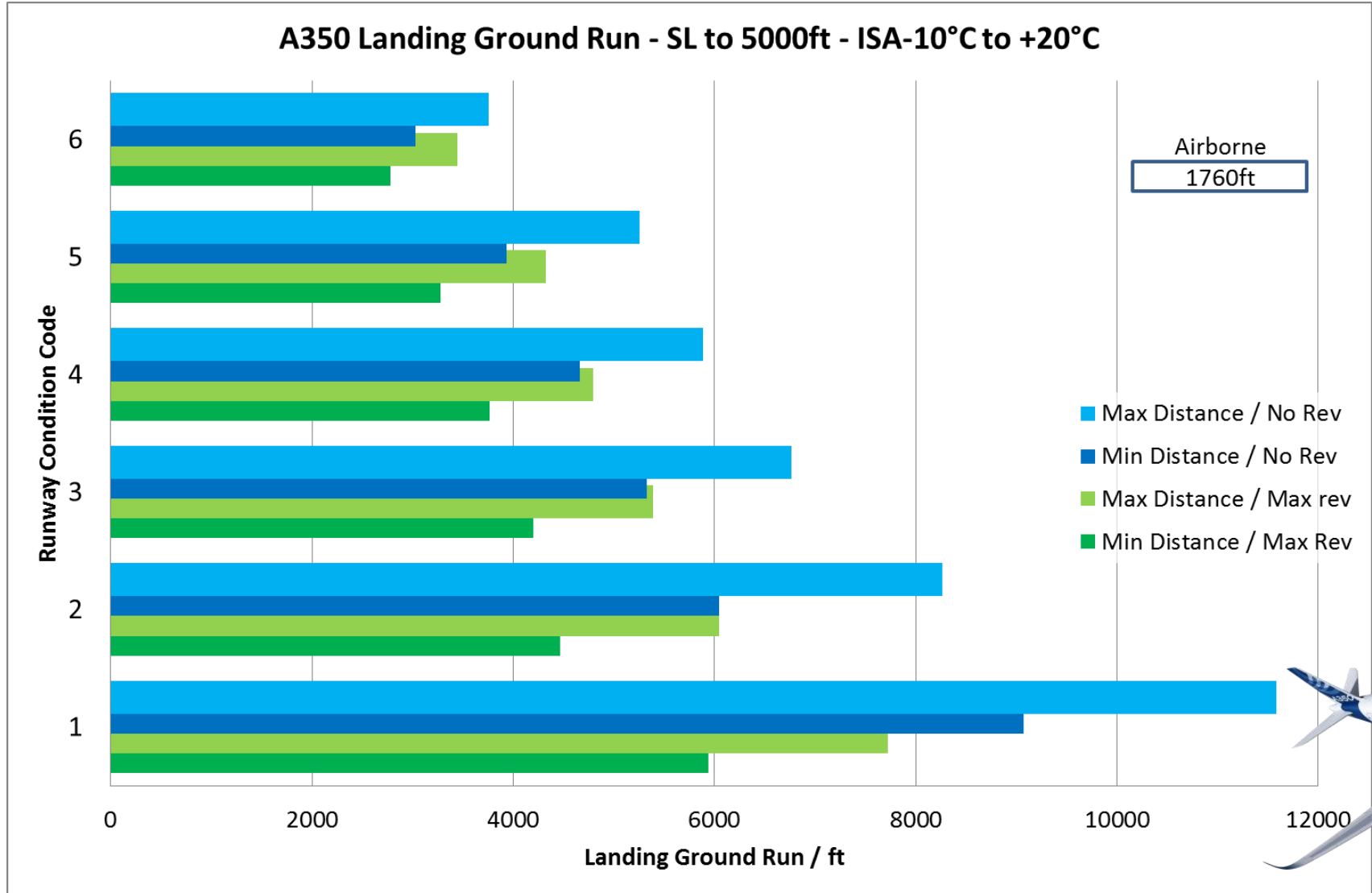
A yellow snowplow is clearing a runway in winter. The background shows a clear blue sky and a line of trees in the distance. The foreground is a snowy and icy runway surface.

Pilots use the runway condition information to prepare their take-off and landing

- **Type, Depth and Coverage are necessary to compute the take-off distance**
- **RWYCC is necessary to compute the landing distance**
- **Runway Thirds is important for situational awareness**

The accuracy and timeliness of the runway condition information is a vital piece of the safety barriers

Cir355 – Overall Landing Ground Run



AIRBUS FCTM

USE OF THE RCAM

The flight crew gathers all available information (e.g. ATIS, METAR, SNOWTAM, TAF, ATC report such as PiRep, NOTAM, Airport Documentation) related to Runway Surface Conditions.

The flight crew makes a **primary** assessment based on Runway Condition information (i.e. runway state, contaminant type, depth, temperature). This results in a **primary** Braking Performance Level.

Then, the flight crew **downgrades** this primary Braking Performance Level, if:

- A Pilot Report of Braking Action (PiRep) is available and this PiRep corresponds to a lower Braking Performance Level
- A SNOWTAM is published, and the Estimated Surface Friction (ESF) corresponds to a lower Braking Performance Level
For loose contaminants (Dry Snow, Wet Snow or Slush), the flight crew should not consider an ESF based on friction measurements.
- Complementary information is available and is related to a possible degradation of the Runway Condition or braking action.

AIRBUS FCTM

RISK OF DEGRADED RUNWAY CONDITIONS

If there is a risk of degraded runway conditions, in addition to the usual assessment with the Braking Performance Level "5 - Good", it is a safe practice to perform a second assessment with "2 - Medium to poor". If the result of the second assessment shows that the runway is too short, it enables the flight crew to anticipate, in the event of degraded runway conditions (e.g. strong rain), an appropriate decision to continue or to discontinue the approach if they become aware of such conditions late in approach. e.g. following a PiRep transmission that contains "Medium to Poor", or following the visual assessment of the runway.

Generally speaking, if there is a possibility that meteorological conditions will change, or under active precipitation, the flight crew should consider performing a backup in-flight landing performance assessment associated with the worst likely Braking Performance Level.



Descent Preparation

9:41 PM Sun Mar 3

My Flight LANDING F-A32C A320-214

IN-FLIGHT

RPLL/MNL NINYOY AQUINO A...

RWY 13

WIND °/kt (160/4)

OAT °C 26 (ISA +11)

QNH hPa 1010

RWY COND 5-Good

LW T 66

LDG CG CG > 27%

LDG CONF CONF FULL (STD)

AIR COND On (STD)

A-ICE Off

APPR TYPE Normal (STD)

GA GRADIENT % 2.1

VPilot kt 0

LDG TECH MAN-A/THR on (STD)

BRK MODE Manual (STD)

REV Yes (STD)

MEL 0 CDL 0 ECAM 0

CLEAR MODIFY

13

VAPP 141 kt

EO GA GRADIENT AT 1516.3 ft 5.1 %

MLW (PERF) 72.6 T

F-LD 1612 m

LD 1401 m

margin 147 m

1759 m

250 m

13

ACARS REPORT			
F04	B-MED	LDIST	LTP
6	DRY	1890	853
5*	GOOD	1890	853
4	G/M	1981	853
3	MED	2103	853
2	M/P	2529	518
1	POOR	----	----

Descent Preparation

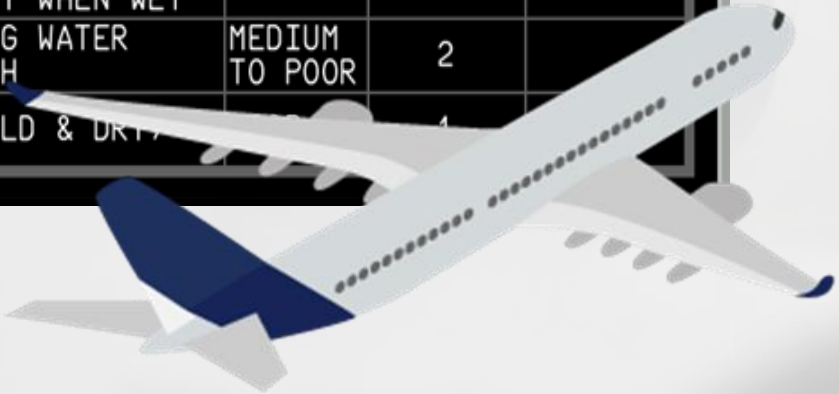
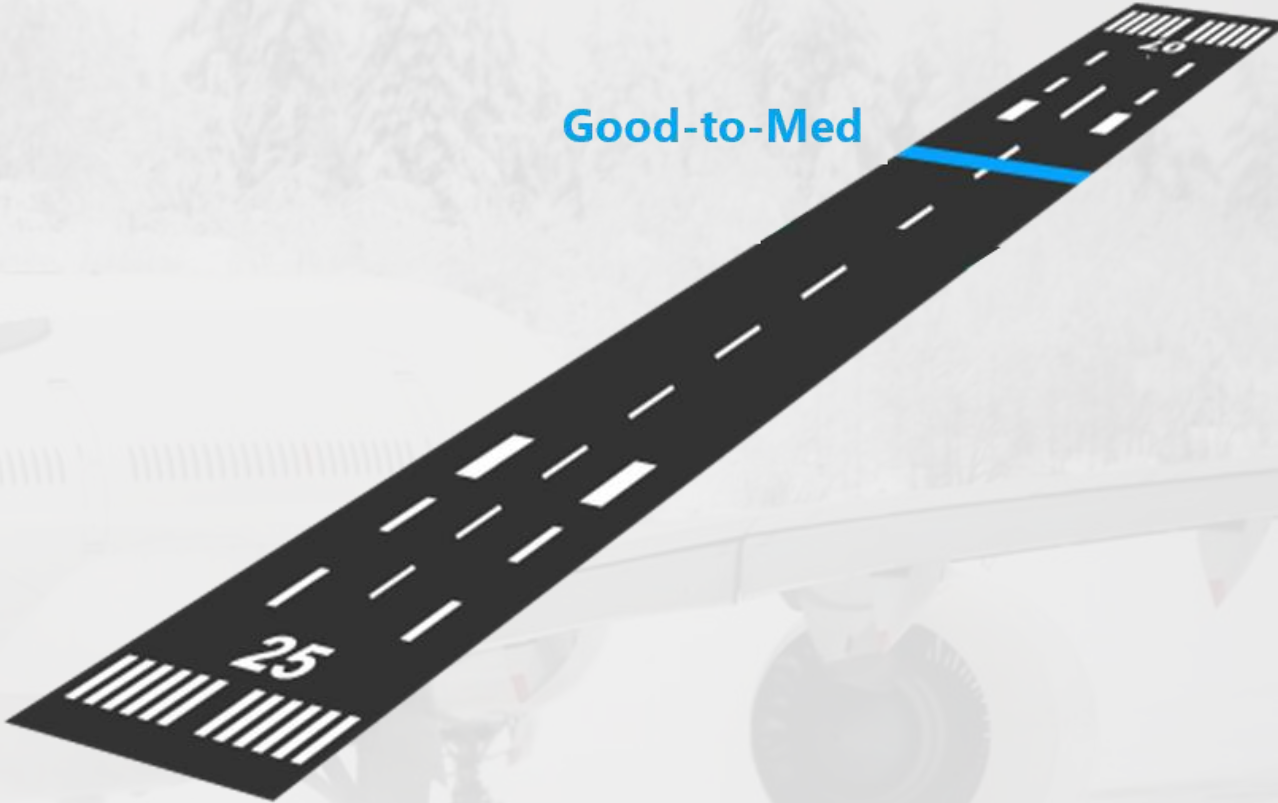


RWY CONDITION / BRAKING ACTION

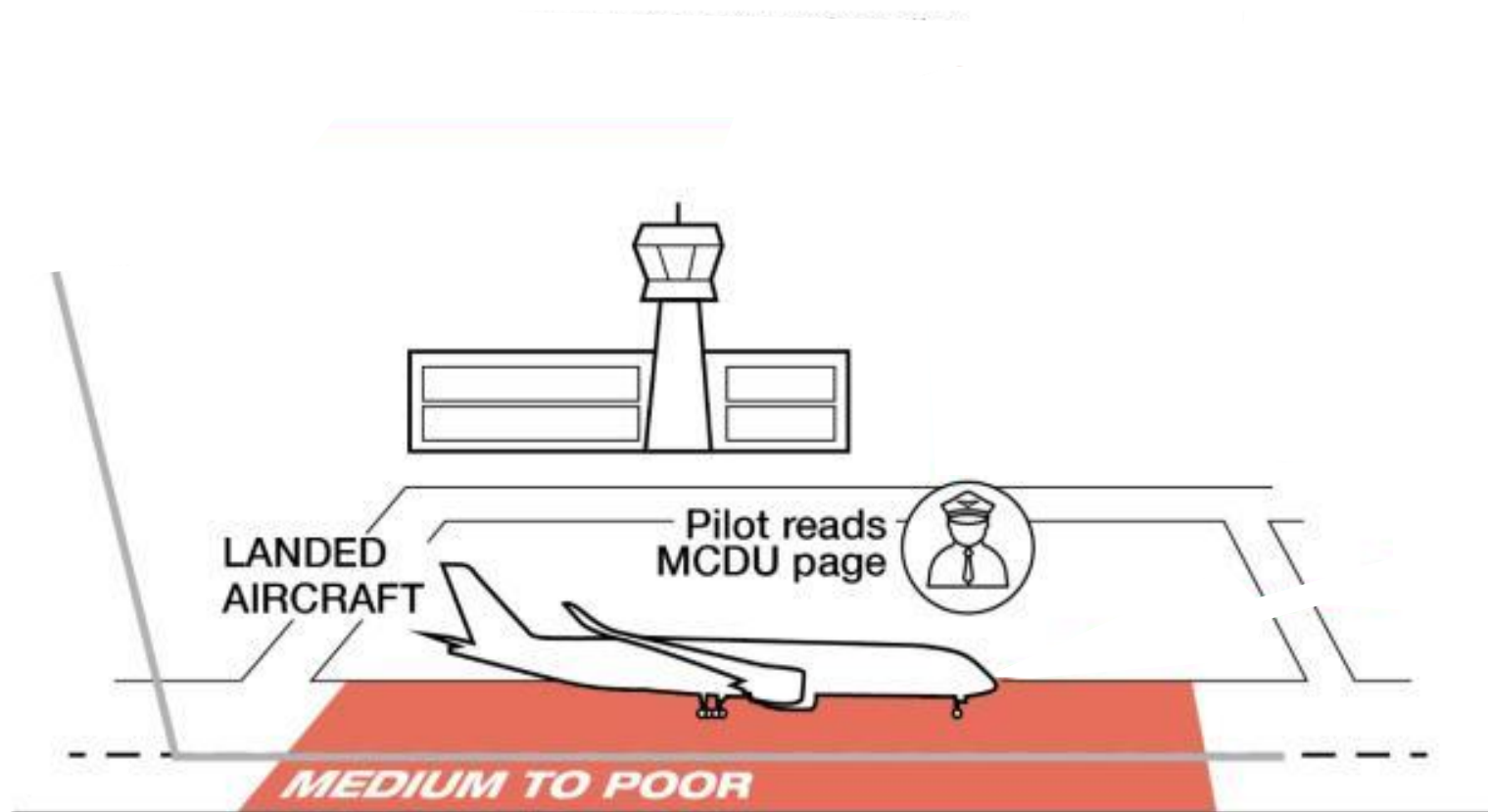
LFBO 14L QNH 998 OAT -5°C
 VAPP 164KT CONF FULL WIND 285°/ 35KT

RWY CONDITION	BRAKING ACTION	LDG PERF CODE
DRY	DRY	6
WET	GOOD	5
COMPACTED SNOW & OAT AT OR BLW -15°C	GOOD TO MEDIUM	4
SLIPPERY WHEN WET	MEDIUM	3
STANDING WATER OR SLUSH	MEDIUM TO POOR	2
ICE (COLD & DRY)	POOR	1

Good-to-Med



Feedback



Takeaways



Performance Relevant Condition Reporting

Runway Condition Codes directly linked to Landing Performance available to Pilots

Thresholds

Representative of effect on aeroplane performance (depth, coverage,...)

Difference between Dry and Wet matters even on long runways

Wet includes Damp

Aircraft data is final arbiter on real runway condition

Thank you!



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**What we observe is not nature herself,
but nature exposed to our method of questioning.**

Werner Heisenberg, theoretical physicist