Winter Operations Conference – Montreal October 5-6, 2011

Operational Landing Distances

Implementing TALPA ARC

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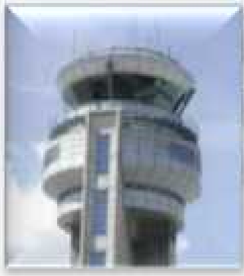
FAA TALPA ARC

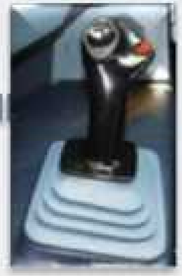
Takeoff and Landing Performance Assessment Aviation Rulemaking Committee

- 2008 — Creation of the Group
- May 2009 — Proposals finalized
- '09/'10, '10/'11 — Winter Trials
- March 2011 — Renewed pressure from NTSB for NPRM

TALPA ARC Concepts

Common rules





Shared operational landing performance computation

- Realistic Air Distance
- Representative Friction
- All physical effects considered

Standardized performance to match reported conditions

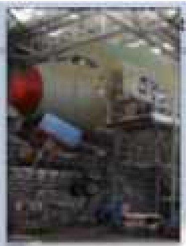
- Standardized runway condition assessment
- Allow performance determination for all types of reports

Rules for Airports

- Attempt to maintain runw
- Make observations
  - As accurately as possib
  - As frequently as require
- Report
  - Runway Codes by thirds
  - Contamination from 10%
  - PiReps
  - No measured friction va
- Close runway
  - One report of “Nil” cond
  - Two consecutive reports

Airport Runway Condition Assessment

Assessment Criteria		Downgrade Assessment Criteria		
Code	**Runway Condition Description**	**Mu (μ)** [1]	**Deceleration And Directional Control Observation**	**PIREP**
6	• Dry		-	-
5	• Wet (Includes water 1/8" or less and Damp) • Frost *1/8" or less depth of:* • Slush • Dry Snow • Wet Snow	40 or Higher	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good
4	*-15°C and Colder outside air temperature:* • Compacted Snow		Brake deceleration and controllability is between Good and Medium.	Good to Medium
3	• Wet ("Slippery when wet" runway) • Dry Snow or Wet Snow (Any Depth) over Compacted Snow *Greater than 1/8" depth of:* • Dry Snow • Wet Snow *Warmer than -15°C outside air temperature:* • Compacted Snow	39 to 30	Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be noticeably reduced.	Medium
2	*Greater than 1/8" depth of:* • Water • Slush	29 to 21	Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.	Medium to Poor
1	• Ice [2]		Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor
0	• Wet Ice [2] • Water on top of Compacted Snow [2] • Dry Snow or Wet Snow over Ice [2]	20 or Lower	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	Nil



Rules for Manufacturers

- Publish Operational Landing Distances
  - “Minimum” Compliance with new principles
    - Cover all 6 friction levels
    - Accountability for
      - Temperature effect
      - Runway slope effect
      - Approach speed increment effect

- Rule to be retroactive

Rules for Operators - Dispatch

Existing dispatch requirements

- Dry runway — RLD dry = 1.67 ALD dry
- Wet — RLD wet = 1.92 ALD dry
- Conta — max of RLD wet
  RLD conta = 1.15 ALD conta

Rules for Operators – in-Flight

- Systematic Landing Performance computation in approach

- Exemptions
  - Dispatch to same **dry** runway under same conditions
  - Dispatch to same **wet grooved** runway under same conditions

- 15% Safety Margin

1.15 x OLD = Factored OLD (FOLD) ≤ LDA

  - Except in case of in flight failures or emergencies

Rules for Operators - Use of Automation

- Automatic Landing
  - Increments to airborne distance as required

- Automatic Braking
  - If **FOLD manual ≤ LDA**
  - And if **OLD a/brk ≤ LDA**

    then **FOLD a/brk > LDA** allowed

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Purpose of Runway Condition Reporting

Provide
- Friction Capability of the Runway

Allow
- Realistic Performance Assessment

Accurate | Complete | Timely | Useful

INHERENT LIMITATIONS REQUIRE MARGINS

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Contaminant Type and Depth

Advantages

- Simple Observation
  - No need for preceding aircraft
  - No need for friction tester
  - No interruption of operations
- Simple equivalence to published performance data

Disadvantages

- May be incomplete and/or misleading
  - Dry Snow / Slush over Ice
  - “Patchy”
  - Friction tends to be worse if contaminant melting
- Depth Assessment difficult (just Wet or already Flooded?)

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Friction Measurement

Advantages

- Precise Numbers
- No need for preceding aircraft

Disadvantages

- No direct correlation with aircraft performance
- Issues with reproducibility
- Optimistic on fluid contaminants
- Requires runway closure for measurement
- Lack in timeliness

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Pilot Braking Action Report

Advantages

- Usually most recent information
- Quantifies effect of contaminant on aircraft

Disadvantages

- Subjective assessment
  - Pilot experience
  - Aircraft characteristics
- Mix of Braking friction, aerodynamic drag and reverse thrust effects
- No correlation with published aircraft performance

FAA TALPA ARC – Runway Assessment Matrix

Airport Runway Condition Assessment		Pilot Reports (PIREPs) Provided To ATC And Flight Dispatch
Assessment Criteria	Downgrade Assessment Criteria	

Reporting Code

Measured Friction

Reported Braking Action

Code	Runway Contaminant	Mu (μ)	Deceleration and Directional Control Observation	PiRep
2	Greater than 1/8" of: •Water •Slush	~29-21	**DOWNGRADE ONLY** Brake deceleration and controllability is between Medium and Poor Potential for hydroplaning exists.	Medium to Poor

Primary Assessment

Differentiation by Temperature

PiRep Guidelines

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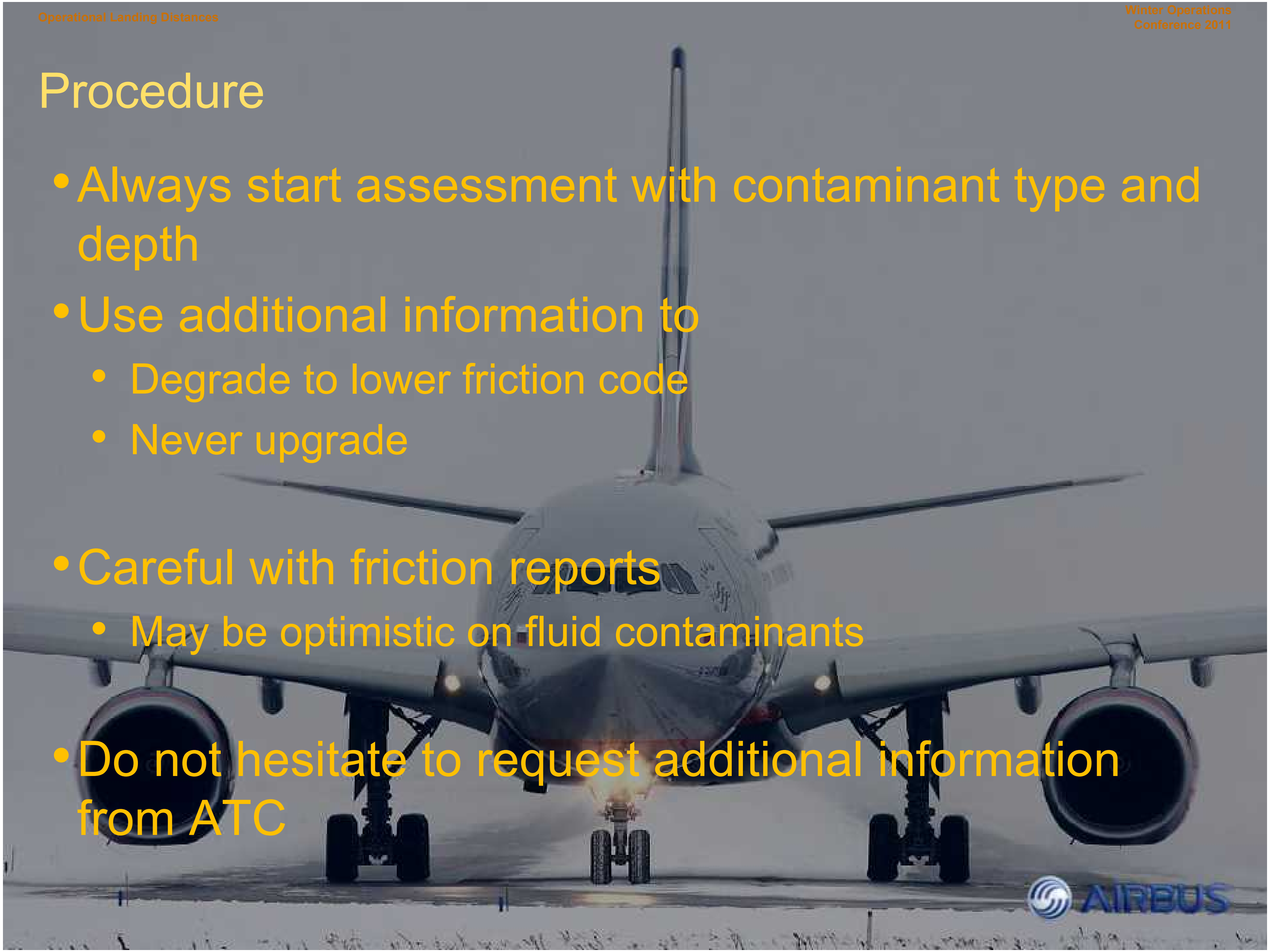

Procedure

- Always start assessment with contaminant type and depth
- Use additional information to
  - Degrade to lower friction code
  - Never upgrade
- Careful with friction reports
  - May be optimistic on fluid contaminants
- Do not hesitate to request additional information from ATC

Examples

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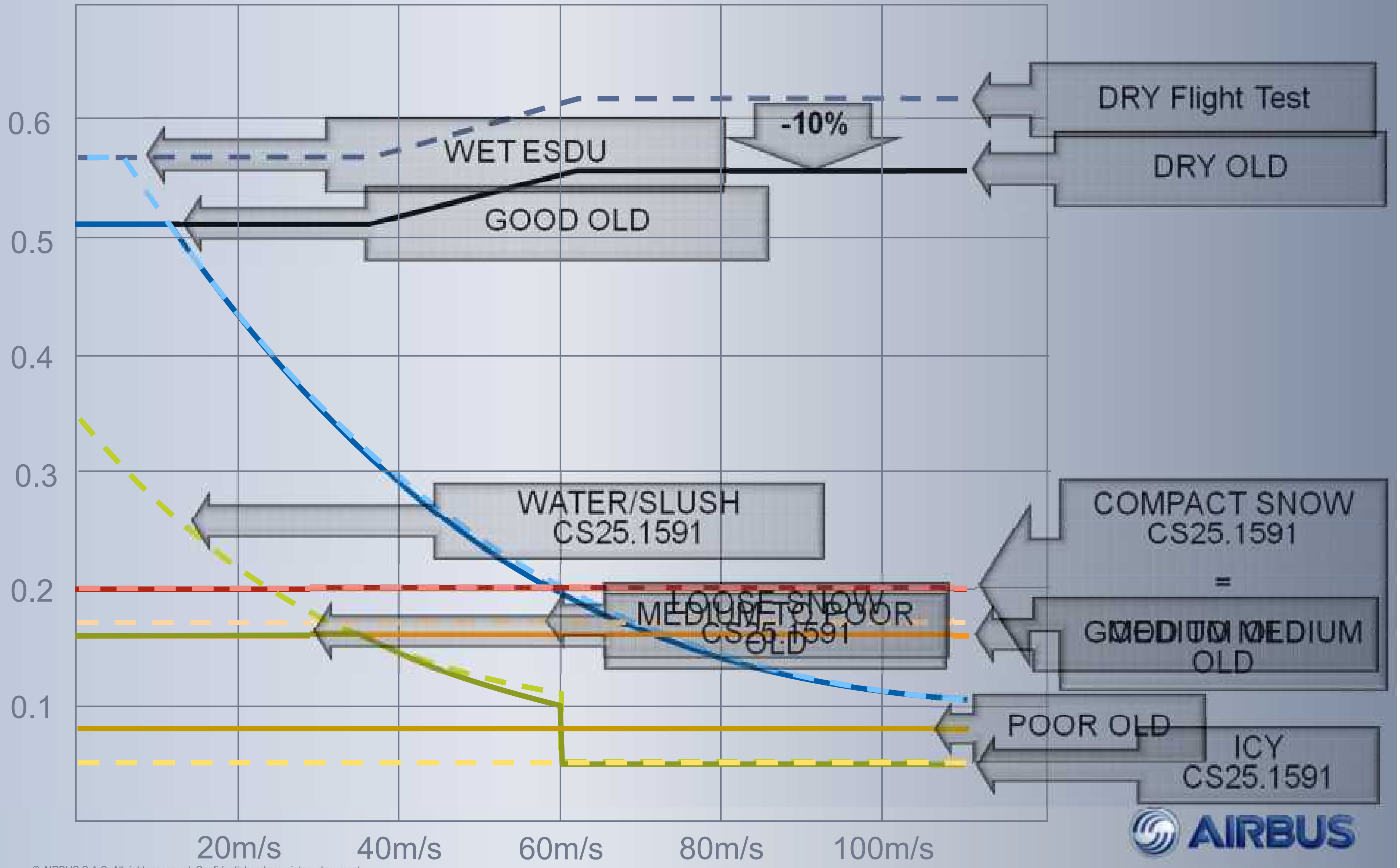
Definition of Operational Landing Distance

- Realistic airborne part

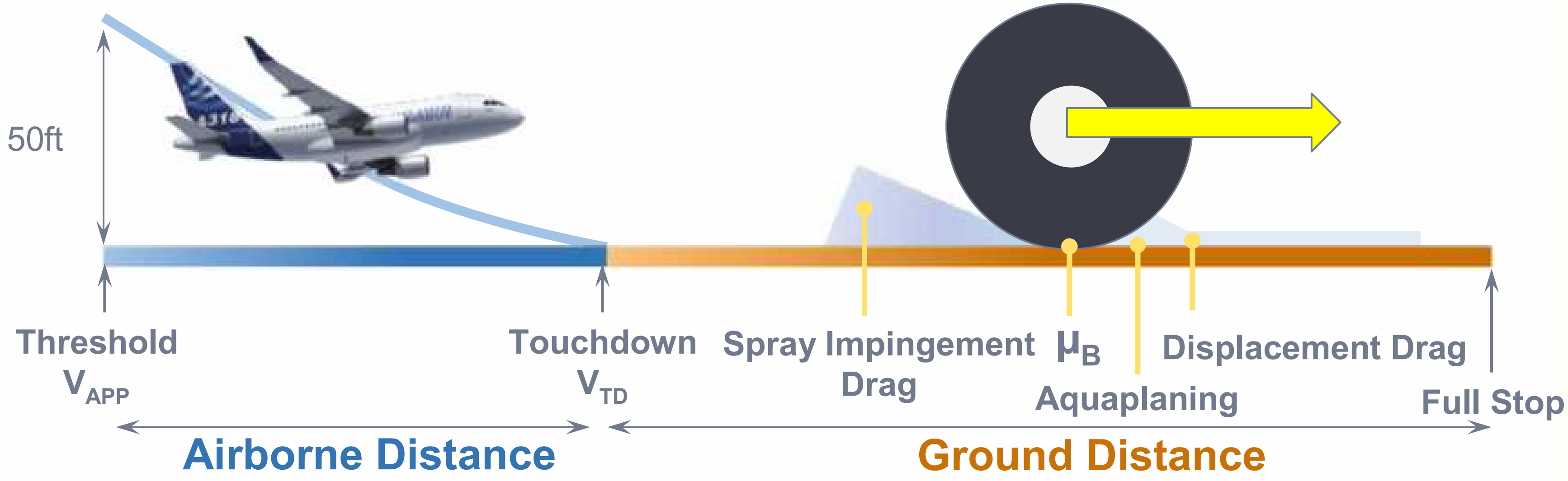
- 6 braking performance levels
  - Labelled by Reported Braking Action (RBA)
  - Good, Medium, Poor and intermediates
  - Matrix becomes compulsory point of entry

- All relevant parameters considered
  - Pressure altitude
  - Planned approach speed
  - Outside temperature and wind
  - Runway slope
  - Reverse thrust use

6 friction levels

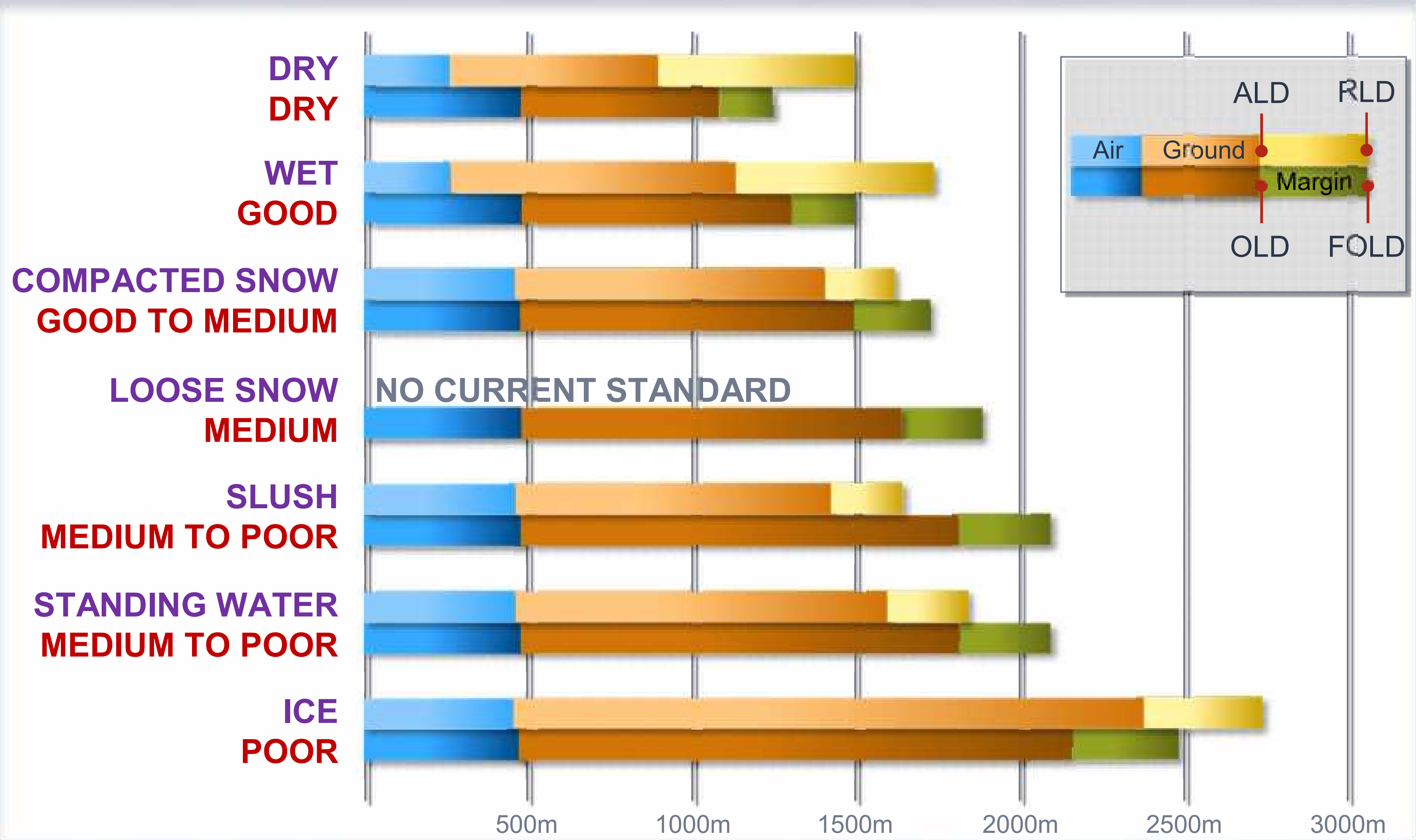


Landing Distance Definitions



- ALD – Actual Landing Distance
- RLD – Required Landing Distance (Dispatch) = ALD x $F_{DISPATCH}$
- OLD – Operational Landing Distance
- FOLD – Factored Operational Landing Distance = OLD x 1.15

Landing Distances: **Legacy** vs. **TALPA ARC**



BOTH BASED ON MAX BRAKING FROM TOUCHDOWN

A320 in Tegucigalpa / Honduras

- MHTG/TGU RWY 02
  - LDA 5410ft / 1649m
  - Elevation 3287ft
- CONF FULL / VREF+5 / no wind / OAT 20ºC

	LW		OLD	FOLD	
Dry	64.5t	**Dry**	1330m	1520m	(no rev)
Wet	59.9t	**Good**	1600m	1830m	(all rev)
Standing Water	53.8t	**Med to Poor**	1910m	2200m	(all rev)

Limited by MLW / Dispatch

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Rulemaking Update

TALPA ARC

• May 2009	Proposals submitted to FAA
• Q3 2011	Update to SAFO 06012
• 2012 /13	AC for Airports, Voluntary OPS Spec, AC91-79
• 2015	Publication of NPRM

Friction Task Force

• 2009/10	Phase 1 – Annex 14 / SNOWTAM / Circular
• 2011-15	Phase 2 – Global Reporting Format, Guidance

Rulemaking

• Q1 2010	In Charge of Airport Operations
• March 2010	Runway Friction and Aircraft Braking Workshop
• 2011-14	Rulemaking Project on Contaminated Runways

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Airbus Implementation Schedule

- **Feb 2010** Presentation of Octopus specification to EASA
- **Aug 2010** Communication to Airlines
- **Q1 2011** Start of PEP/LPC Validation
- **Apr 2011** PEP/FM Approval by EASA
- **Q2 2011** Finalisation of Publication Method and Format
- **Q3 2011** Start of Production of Documentation
- **Q4 2011** OCTOPUS v28 Certification by EASA
- **Mid 2012** Publication for A318/319/320/321/330/340
- **Q3 2012** Publication for A306/310/380

OLD Implementation by Airbus

- For all Airbus aircraft
  - At least “Minimum Compliance” with new principles
    - Cover all 6 friction levels
    - Accountability for
      - Temperature effect
      - Runway slope effect
      - Approach speed increment effect
- All Performance data sources
  - Flight Ops Engineer Software
  - Flight Manual
  - Operational Documentation
  - Electronic Flight Bag
  - Training Material

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Operational Documentation - QRH

OLD - GOOD

The Reference Distance (REF DIST) is for Sea Level (SL), ISA temperature, no wind or slope, VAPP(Approach speed)=VLS, no engine reverse thrust

CONF FULL

Corrections on landing distance (m)		WEIGHT		SPD	ALT	Wind	TEMP	SLOPE	REV
Braking mode	REF DIST (m) for 66T	per 1T BELOW 66T	per 1T ABOVE 66T	per 5kt	per 1000ft above SL	per 5kt TW	per 10°C above ISA	per 1% down slope	Per thrust reverser operative
Max Manual	1410	-10	+ 20	+ 110	+ 70	+ 210	+ 70	+ 50	- 70
Autobrake Med	1460	-10	+ 20	+ 110	+ 70	+ 210	+ 70	+ 50	- 20
Autobrake Low	1960	-20	+ 30	+ 140	+ 70	+ 200	+ 70	+ 30	- 20

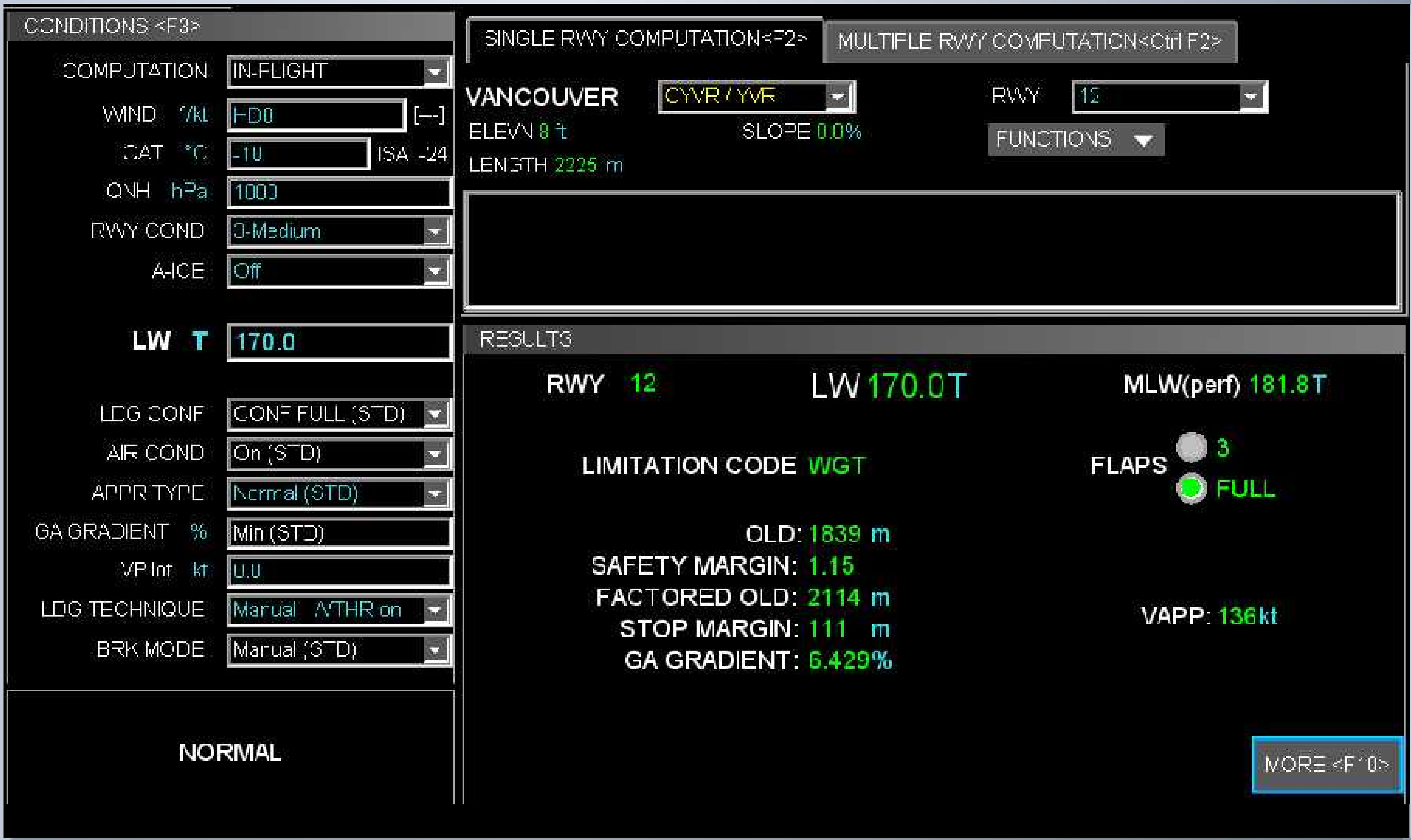
For Overweight Landing, add **120 m**
For Autoland, add **350 m**

CONF 3

Corrections on landing distance (m)		WEIGHT		SPD	ALT	Wind	TEMP	SLOPE	REV
Braking mode	REF DIST (m) for 66T	per 1T BELOW 66T	per 1T ABOVE 66T	per 5kt	per 1000ft above SL	per 5kt TW	per 10°C above ISA	per 1% down slope	Per thrust reverser operative
Max Manual	1550	-20	+ 20	+ 120	+ 80	+ 220	+ 70	+ 60	- 80
Autobrake Med	1600	-20	+ 20	+ 120	+ 80	+ 220	+ 70	+ 60	- 40
Autobrake Low	2100	-20	+ 30	+ 150	+ 80	+ 210	+ 80	+ 30	- 20

For Overweight Landing, add **120 m**
For Autoland, add **350 m**

EFB Landing Application



EFB Landing Application

EFB Landing Application

Conclusion

- Airbus adopts TALPA ARC standard for in-flight landing performance
- Realistic computation basis for all winter runway conditions
- In current environment, pilot must compensate for non yet compliant Runway Condition Reporting
- Major safety improvement requires

SHARED GLOBAL
ASSESSMENT & REPORTING STANDARDS

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