

Runway Friction Characteristics Measurement and Aircraft Braking

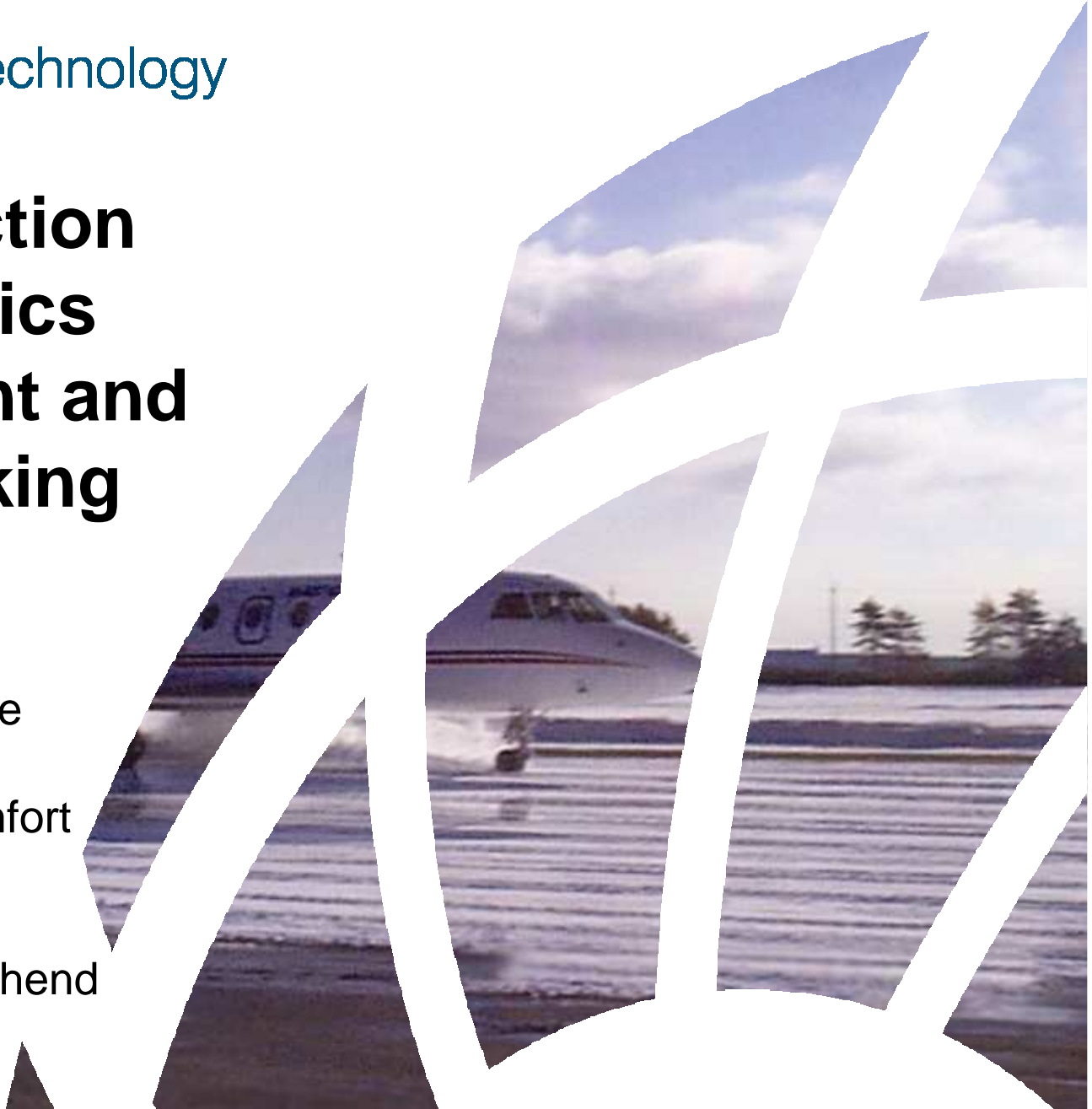
Sponsor: EASA

Location: Paris, France

By BMT FTL:

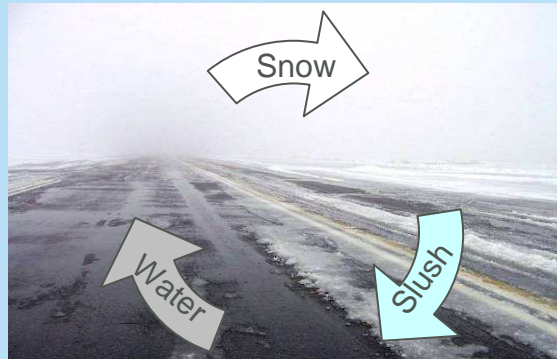
- George Comfort
- Zoltan Rado
- Al Mazur
- Terry Townshend

March, 2010



EASA (RuFAB) RCR – The Basics

- **EASA RuFAB Team Objectives**
 - Identify or advise in closing the Knowledge gaps
 - Focus – Global Applicability
- **Issues**
 - a) Taxonomies and Definitions
 - b) Operational Friction Measurement
 - c) Runway Condition Assessment
(parameter observation & measurement)
 - d) Condition Reporting
 - e) Condition measurement technologies.



EASA Runway Friction and Braking (RuFAB)

External Activities

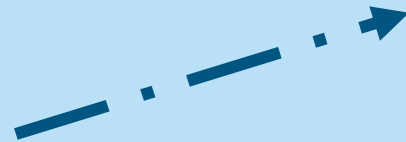
- **TALPA-ARC – represent a broad spectrum of stakeholders within the aviation community**
 - Holistic approach based on aircraft performance requirements
 - Discusses impact of ground friction measurements, PiREPS and contaminant parameters
 - 2009/2010 trial results will be telling
 - Reviews would be advantageous
 - Background to decisions
 - Reference materials
 - Reports
 - Trials results



If a similar approach were adopted by EASA there would be a direct effect on CAA standards, air carriers, and airports – European trials ?

EASA Runway Friction and Braking (RuFAB) Overall Objective

- **Facilitate the improvement of aeroplane take-off and landing performance (TaLP) by better provision and use of runway condition information.**



EASA Runway Friction and Braking (RuFAB)

Issues - Definitions (TALPA-ARC)

• Contaminated:

- >25% usable area covered with 3mm loose contaminants or any compact snow or ice

• Dry:

- not 'Contaminated' + 75% usable area clear of visible moisture

• Wet:

- Not 'Contaminated'
- Not 'Dry'

• Not included in above:

- < 3mm of Frost at >25% coverage of usable area
- < 25% coverage of usable area
- Damp

Knowledge gap

A. Validation required

B. Clarification for recognition / measurement.

PAVED RUNWAY CONDITION ASSESSMENT TABLE

Airport Estimated Runway Condition Assessment				Pilot Reports (PIREPs) Provided To ATC And Flight Dispatch
Runway Condition Assessment – Reported		Downgrade Assessment Criteria		
Code	Runway Description	Mu (μ)	Deceleration And Directional Control Observation	PIREP
6	• Dry	-	-	Dry
5	• Wet (Smooth, Grooved or PFC) • Frost <i>1/8" or less of:</i> • Water • Slush • Dry Snow • Wet Snow	40μ or higher	Braking deceleration is normal for the wheel braking effort applied. Directional control is normal.	Good
4	<i>At or below -13°C:</i> • Compacted Snow	39-36μ	Brake deceleration and controllability is between Good and Medium.	Good to Medium
3	• Wet (Slippery) <i>At or below -3°C:</i> • Dry or Wet Snow greater than 1/8" <i>Above -13°C and at or below -3°C:</i> • Compacted Snow	35-30μ	Braking deceleration is noticeably reduced for the wheel braking effort applied. Directional control may be slightly reduced.	Medium
2	<i>Greater than 1/8" of:</i> • Water • Slush <i>Above -3°C:</i> • Dry or Wet Snow greater than 1/8" • Compacted Snow	29-26μ	Brake deceleration and controllability is between Medium and Poor. Potential for hydroplaning exists.	Medium to Poor
1	<i>At or below -3°C:</i> • Ice	25-21μ	Braking deceleration is significantly reduced for the wheel braking effort applied. Directional control may be significantly reduced.	Poor
0	• Wet Ice • Water on top of Compacted Snow • Dry or Wet Snow over Ice <i>Above -3°C:</i> • Ice	20μ or lower	Braking deceleration is minimal to non-existent for the wheel braking effort applied. Directional control may be uncertain.	Nil

Notes:

- **Contaminated runway.** A runway is contaminated when more than 25 percent of the runway surface area (whether in isolated areas or not) within the reported length and the width being used is covered by water, slush, frost or snow greater than 0.125 inches (3 mm), or any compacted snow or ice.
- **Dry runway.** A runway is dry when it is not contaminated and at least 75% is clear of visible moisture within the reported length and width being used.
- **Wet runway.** A runway is wet when it is neither dry nor contaminated.
- Temperatures referenced are average runway surface temperatures when available, OAT when not.
- While applying sand or liquid anti ice to a surface may improve its friction capability, no credit is taken until pilot braking action reports improve or the contaminant type changes (e.g., ice to water).
- Compacted Snow may include a mixture of snow and imbedded ice.
- Compacted Snow over Ice is reported as Compacted Snow.
- Taxi, takeoff, and landing operations in Nil conditions are prohibited.

EASA Runway Friction and Braking (RuFAB)

Issues - Definitions (TALPA-ARC) (cont.)

- Surface temperature must be measured
- No depth measurement required for loose or liquid contaminants other than depth threshold of 3mm (1/8")
- Various surface conditions result in the same performance code
- Distinguishing between some pairs of contaminants is not important for reasons of aircraft performance – e.g. dry snow vs. wet snow
- RIs have to identify defined contaminants so that their potential impact can be assessed
- Contaminant layering must be reported

A. Implications ?

Knowledge gap

B. Clarification for purposes of recognition / measurement ?

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EASA Runway Friction and Braking (RuFAB) Issues - **Definitions** (TALPA-ARC) (cont.)

- Only 7 reportable condition codes – simpler for aeroplane TaLP determination
 - But
 - RIs will still have to discern each of the defined wet and contaminated states
- No classification for unnamed contaminants
- No definition for Frost.

PAVED RUNWAY CONDITION ASSESSMENT TABLE

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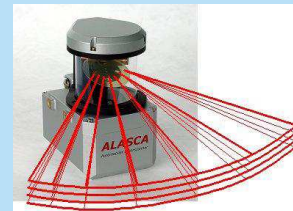
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EASA Runway Friction and Braking (RuFAB) Issues

- **Challenges with accuracy of friction measurement are leading agencies to focus on predicting TaLP based on descriptions of surface contaminants**

but

- **Surface contaminants are visually assessed, not measured**
- **Contaminant measuring equipment is on the horizon – not here**
- **Human Factors affect RCR accuracy.**



EASA Runway Friction and Braking (RuFAB) **Issues**

- **No regulated requirements for Runway Inspector (RI) qualifications or training**
- **RIs routinely have to wait to inspect runways and are then rushed to complete inspections.**



EASA Runway Friction and Braking (RuFAB) Issues

- **Terminology used to describe runway conditions by RIs is not standardized**
- **Runway state (dry, wet, contaminated) and condition descriptions used to describe aeroplane TaLP are not standardized or harmonized**
- **NOTAM distribution can be delayed because of transposition**
- **Condition reports and NOTAMS can quickly get 'stale'**
- **No requirement for Aeroplane Flight Manuals to use standardized TaLP information**
- **No system for feeding aeroplane TaLP data back to aeroplane manufacturers or Regulators.**



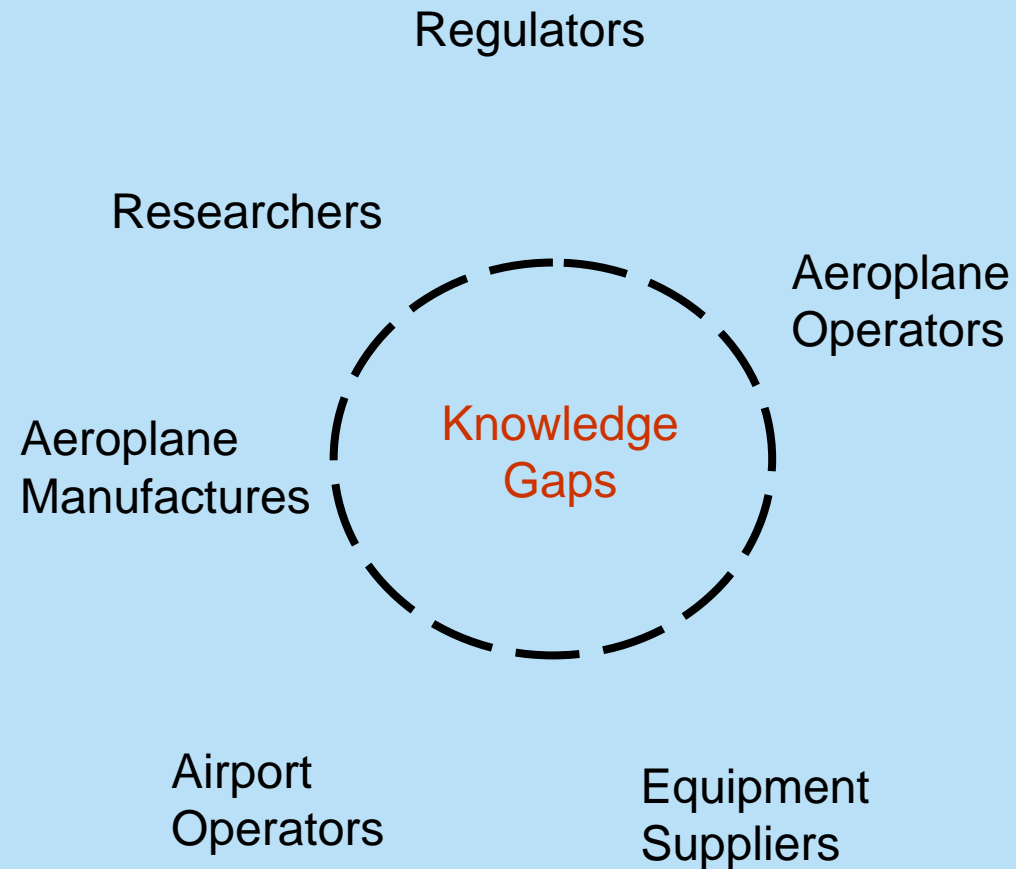
EASA Runway Friction and Braking (RuFAB) **Issues**

Stuff happens in “Summer”

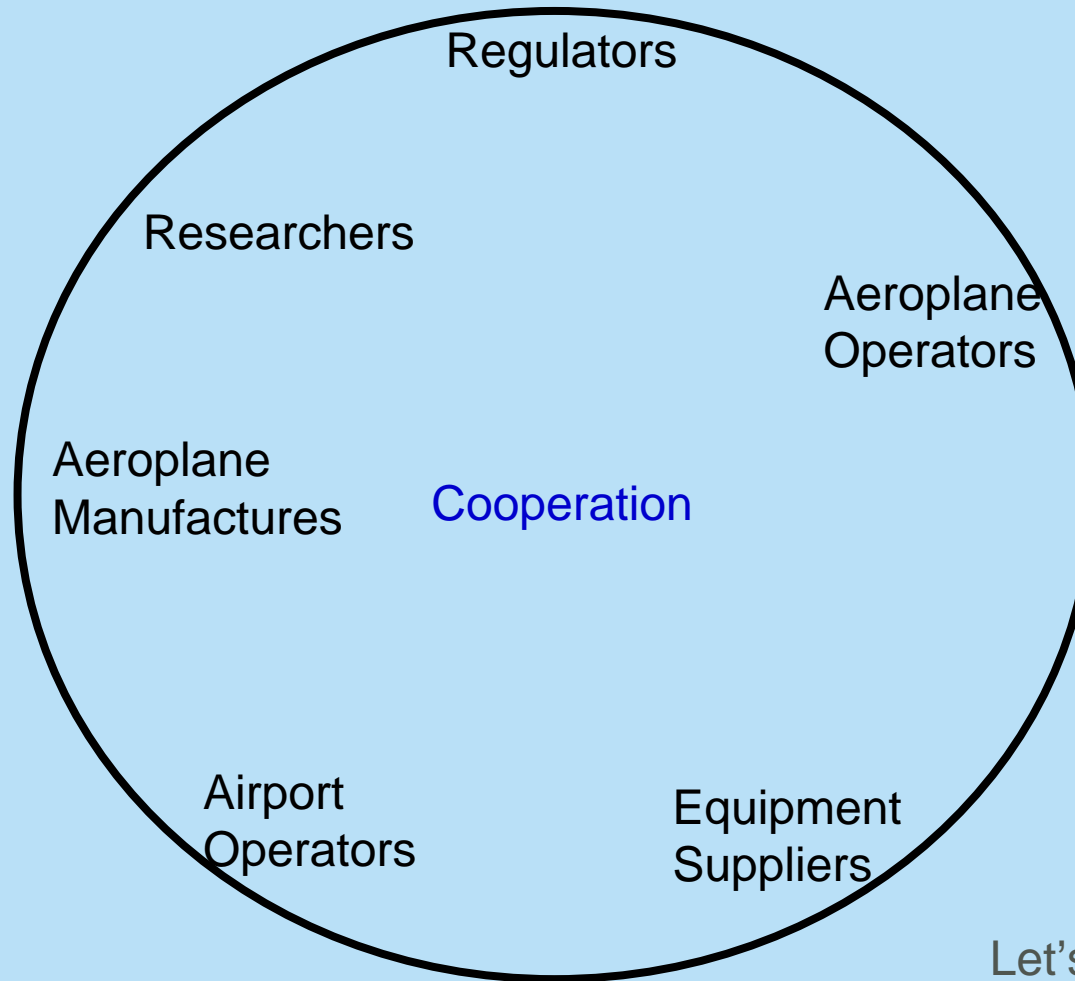


We do not provide systematic conditions reports.

EASA Runway Friction and Braking (RuFAB) **Issues**



EASA Runway Friction and Braking (RuFAB) **Issues**



Let's move on.....