



GRF Methodology

History and Development Process

Lars Kornstaedt / Rapporteur Annex 6/8 Subgroup, Friction Task Force
GRF Workshop, Frankfurt
10 December 2019

AIRBUS

Elizabethan Crash in Munich

- February 6th, 1958 - BEA Airspeed Ambassador G-ALZU *Lord Burghley* crashed on the third attempt to takeoff from a slush-covered runway in Munich-Riem
- Aircraft carried Manchester United football team
- 23 fatalities
- Cause: Aircraft was unable to accelerate to flying speed due to precipitation drag



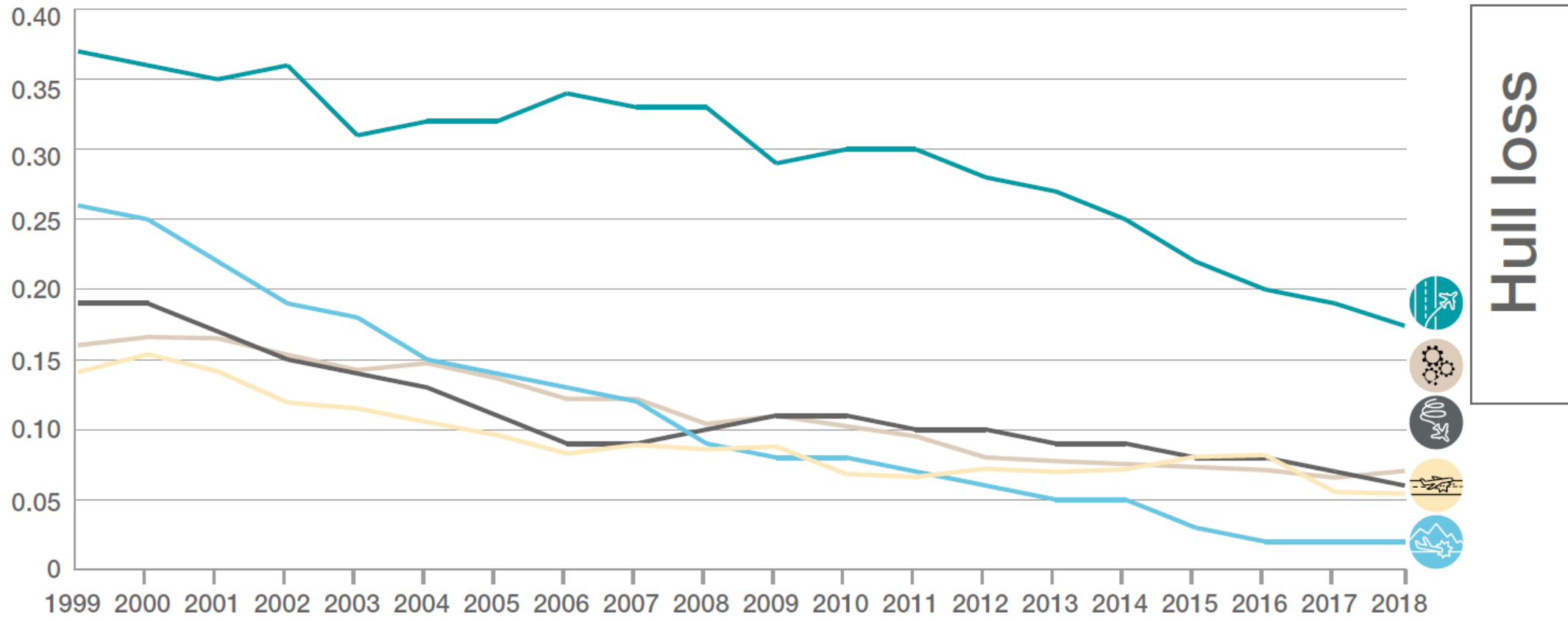
Runway Overrun Chicago-Midway

- December 8th, 2005 Southwest Flight 1248 slides off the runway while attempting to land in a snowstorm
- 1 fatality on ground



Accident Statistics

10 year moving average hull loss rate by accident category per million flights



Top 3 Safety Concern

- Runway Safety: A global safety priority
 - Runway excursions: highest risk category
 - Poor braking action: a top contributing factor
 - Mitigation by ICAO's Global Reporting Format
 - World-wide implementation agreed
- Applicability November 2020



Acronyms

- Global Reporting Format (GRF)
- Runway condition assessment matrix (RCAM)
- Runway condition code (RWYCC)
- Runway condition report (RCR)
- SNOWTAM - special series NOTAM
- AIREP (Air-report) - report from an aircraft



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What Next?

FAA TALPA ARC Terms of Reference

- a) Establish airplane certification and operational requirements (including training) for takeoff and landing operations on contaminated runways.
- b) Establish landing distance assessment requirements, including minimum landing distance safety margins, to be performed at the time of arrival.
- c) Establish standards for runway surface condition reporting and minimum surface conditions for continued operations.




FAA TALPA ARC

Takeoff and Landing Performance Assessment
Aviation Rulemaking Committee



TALPA Proposals





U.S. Department of Transportation
Federal Aviation Administration

SAFO

Safety Alert for Operators

SAFO 00012
DATE: 9/31/06

Flight Standards Service
Washington, DC

http://www.faa.gov/other_visit/aviation_industry/talpa_operators/talpa_safos/safos

A SAFO contains important safety information and may include recommended actions. TALPA entries should be especially valuable to air carriers in meeting their statutory duty to provide service with the highest possible degree of safety in the public interest.


Subject: Landing Performance Assessment at Time of Arrival (Turbojets)

- Purpose.** This SAFO urgently recommends that operators of turbojet airplanes develop procedures for flightcrews to assess landing performance based on conditions actually existing at time of arrival, as distinct from conditions presumed at time of dispatch. Those conditions include weather, runway conditions, the airplane's weight, and braking systems to be used. Once the actual landing distance is determined an additional safety margin of at least 15% should be added to that distance. Except under emergency conditions flightcrews should not attempt to land on runways that do not meet the assessment criteria and safety margins as specified in this SAFO.
- Discussion:** This SAFO is based on the FAA's policy statement published in the Federal Register on June 7, 2004, and incorporates revisions based on public comments received by the FAA. Accordingly, the FAA has undertaken rulemaking that would explicitly require the practice described above. Operators may use Operator/Management Specification paragraph C582 to record their voluntary commitment to this practice, pending rulemaking.

Operators engaged in air transportation have a statutory obligation to operate with the highest possible degree of safety in the public interest.

- Applicability:**
 - This SAFO applies to all turbojet operators under Title 14 of the Code of Federal Regulations (14 CFR) parts 121, 135, 125, and 91 subpart K. The intent of providing this information is to assist operators in developing methods of ensuring that sufficient landing distance exists to safely make a full stop landing with an acceptable safety margin on the runway to be used, in the conditions existing at the time of arrival, and with the deceleration means and airplane configuration that will be used. The FAA considers a 15% margin between the expected actual airplane landing distance and the landing distance available at the time of arrival as the minimum safety margin for non-emergency operations.
 - The FAA acknowledges that flightcrews may not know the absolute performance capabilities of their aircraft. Those situations include engine failures or abnormal aerodynamic characteristics, such as engine failure during climb or loss of lift control.

Approved by AFS-1 Page 1



U.S. Department of Transportation
Federal Aviation Administration

Advisory Circular

Subject: Runway Overrun Prevention **Date:** 11/06/07 **AC No:** 91-79

Initiated by: AFS-800 **Change:**

- PURPOSE.** This advisory circular (AC) provides ways for pilots and operators of turbine-powered airplanes to identify, understand, and mitigate risks associated with runway overruns during the landing phase of flight. It also provides operators with detailed information that may be used to develop company standard operating procedures (SOP) to mitigate those risks.
- AUDIENCE.**
 - This document provides guidance to flightcrews, aircraft operators, certificate holders, program managers, training providers, and pilot examiners that conduct turbine-powered airplane operations or provide support services to such operations. These concepts also apply to other types of airplane operations, and some operators must adhere to more restrictive guidance based on their applicable operations or management specifications.
 - Turbine aircraft operators, certificate holders, program managers, training centers, and other support providers should adopt the recommended procedures found in this AC to help mitigate the risk of runway overruns. This should include the creation or revision of SOP, training programs and courseware, and company policies and procedures to reinforce the risk mitigation strategies. For Title 14 of the Code of Federal Regulations (14 CFR) part 91 subpart K, part 121, 125, or 135 operators, these procedures and programs should be incorporated into the certificate holder's or program manager's operations manual system as appropriate. Part 91 turbine operators are encouraged to review this material and to include it in the applicable company documents.

3. RELATED READING MATERIAL (current editions).

- AC 25-7, Flight Test Guide for Certification of Transport Category Airplanes
- AC 60-22, Aeronautical Decision Making
- AC 120-71, Standard Operating Procedures for Flight Deck Crewmembers
- AC 121.17, Operational Landing Distances for Transport Category Airplanes
- Notice 8001, Issued on October 8, 2003, Vol. 1, Chapter 9

91-79

April 15, 2006

Ms. Margaret Gilger
Assistant Administrator, Aviation Safety
Federal Aviation Administration
300 Independence Ave., SW
Washington, DC 20591

Dear Ms. Gilger:

On behalf of the many dedicated volunteers and team leaders of the Take-off and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC), I am pleased to present you with our final set of recommendations addressing improvements in landing assessments for contaminated runway operations. The TALPA ARC Steering Committee formally acted on these recommendations, set forth at our meeting in Denver, CO (9/18/05).

The recommendations included in this package primarily address modifications to existing rules required under Federal Aviation Regulations Part 25, 26, 121, 135 and 136. Additionally, the ARC developed an Airport Condition Reporting guide, affectionately called "the matrix," that would assist airports in reporting contamination of runway surfaces. This cover letter will summarize the recommendations, and clarify where we were unable to breach consensus.


Part 25 Recommendations
The Steering Committee voted unanimously to forward these recommendations to the FAA. The recommendations for modifications to FAR Part 25 follow principles already established for high performance airplanes in the recommendations to the FAA from the Part 125 / 126 rulemaking committee. These recommendations would apply certain elements of the changes proposed for FAR Part 25 to FAR Part 25 multi-engine turboprop and turboshaft category aircraft.

Part 26 Recommendations
The Steering Committee voted unanimously to forward these recommendations to the FAA. The ARC believes that this set of recommendations will improve safety for low altitude. This proposal builds on the existing EASA requirements and the ARC members from the manufacturer industry in the United States, Canada, Europe and Brazil believe it is critical that the FAA work with its European counterparts toward fully harmonized requirements for certified landing distance performance as part of its co-operation in the Agreement of Cooperation in the Regulation of Aviation Safety between the United States and the European Community.

A key element of our process ensured that FAA would hear all perspectives on a particular issue. The Air Line Pilots Association (ALPA) voted in favor of this recommendation. It has submitted additional information to consideration.

ON ASSESSMENT TABLE			
Assessment	Downgrade Assessment Criteria	Pilot Reports (PROPRs) Provided To ARC And Flight Ops Staff	PROPR
Determination and Decision Making			
Runway Condition	is normal for the runway after normal operations under no circumstances is normal		Dry
Weather and Visibility	weather is normal for the runway under no circumstances is normal		Good
Runway	is normal for the runway under no circumstances is normal		Good
Braking and Contamination	braking action is normal for the runway under no circumstances is normal		Good
Surface	is normal for the runway under no circumstances is normal		Good
Obstacles	obstacles are normal for the runway under no circumstances is normal		Good
Runway	is normal for the runway under no circumstances is normal		Good
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TALPA ARC Concepts



<h2>Common rules</h2>	<ul style="list-style-type: none">• For all airports• For all manufacturers• For all operators
<h2>Shared operational landing performance computation</h2>	<ul style="list-style-type: none">• Realistic Air Distance• Representative Friction• All physical effects considered
<h2>Standardized performance to match reported conditions</h2>	<ul style="list-style-type: none">• Standardized runway condition assessment• Allow performance determination for all runway conditions

FAA Validation of TALPA ARC Proposals



TALPA ARC transmitted proposals to FAA in May 2009

TALPA ARC was closed in Nov 2009



FAA conducted two Winter Validation Trials 2009/10 & 2010/11

Debrief of TALPA members 2011



Final report was issued Apr 2013

Release of updated AC91-79A in Sept 2014



AIRBUS

FAA Implementation by Voluntary Compliance

- Effective October 2016
- Advisory documents
 - SAFO 16009
 - Part 25 ACs
 - Part 150 ACs
 - Joint Orders, AIM, ...
- Compulsory reporting
 - NOTAM Manager



TALPA Industry Day – Washington June 9, 2016

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Leading up to the Friction Task Force

AOSWG/1 – June 2005

Need to standardise information to pilots

ICAO State letter - May 2006 – Questionnaire

Aerodrome Panel - 1 December 2006

AOSWG/5 – April 2008

ICAO Friction Task Force - April 2008



FTF Phase 1 (2008 – 2011)

- Annex 14 and (Annex 15)
- Revised Reporting Procedure
- Revised SNOWTAM

MEASURED OR CALCULATED COEFFICIENT	or	ESTIMATED SURFACE FRICTION		
0.4 and above		GOOD	—	5
0.35 and above		MEDIUM/GOOD	—	4
0.3 and above		MEDIUM	—	3
0.25 and above		MEDIUM/POOR	—	2
0.2 and below		POOR	—	1
9 — unreliable		UNRELIABLE	—	9

Since 14 November, 2013

- Circular 329 – Assessment, Measurement and Reporting of Runway Surface Conditions

No longer reporting μ



Friction measuring equipment values are no longer used to determine and report surface conditions because joint industry and multi-national government tests have not established a reliable correlation between runway friction values and the relationship to airplane braking performance.

*FAA SAFO 19001 - Landing Performance Assessment at Time of Arrival
11 March 2019*

ICAO Friction Task Force Phase 2 (2011 – 2019)

Problem Statement

Runway surface conditions have contributed to many safety events and investigations have revealed **shortfalls in the accuracy and timeliness of assessment and reporting methods** currently provided for in ICAO provisions and guidance material.



International Coordinating Council of Aerospace Industries Associations

Overrun Characteristics

Preparation

No approved in-flight realistic operational landing distance

Stability

Unstable Approach
(Too High, Too Fast)

Tailwind

"Floating"

Long-Landing

High touchdown speed

Configuration

Friction limited / Runway contamination

Speedbrakes late / not deployed

Reversers late / Not deployed

Reverser level too low / Reduced too soon

Overruns often are caused by more than one factor!

Source: FDR data sent to Boeing Aero Safety, 2003-present, Models: Boeing Puget Sound

Decision Height





International Coordinating Council of Aerospace Industries Associations

Overrun Risk Mitigations

Suggested Operation and Procedural enhancement:

- Runway conditions reporting
- In-flight realistic landing distance calculation
- Stabilized approach

- Touchdown zone marking
- "De-stigmatize" Go-Around

- Configuration*
- Use all deceleration devices
 - Maintain thrust reverser deployment

Suggested equipage enhancements:

- Stability alerting
- Real time dynamic performance prediction
- Aural and visual Go-Around decision aids
- Head-Down and Head-Up visual cues

- Real time dynamic performance prediction
- Aural and visual Go-Around decision aids
- Head-Down and Head-Up visual cues
- Flare guidance

- Real time dynamic stopping distance estimation
- Aural and visual deceleration devices usage aids
- Head-Down and Head-Up visual cues
- Deceleration alerting

Jobcard

PART I				
Category	Safety	Sustainability	Implementation	Reference: AP001
Title	Assessment and reporting of runway surface conditions			
Proposed by	Secretariat/WG-PDP			
Problem Statement	Runway surface conditions have contributed to many safety events and investigations have revealed shortfalls in the accuracy and timeliness of assessment and reporting methods currently provided for in ICAO provisions and guidance material			
Specific Details (including impact statements)	While techniques for the measurement of runway friction provide useful information for runway surface friction maintenance purposes, they are not suitable in all weather conditions when the runway is contaminated and the information when used in reports could be misleading to pilots. Reports used by pilots also need reports that are directly related to the runway condition and assessing conditions for reports. In addition, reports use terms "damp" and "slippery when wet", and how to use them are not now available or under development, and need to be developed and construction that aid friction and drainage. The			

...need reports that are directly related to the performance of the aircraft.

Runway surface conditions have contributed to many safety events and investigations have revealed shortfalls in the accuracy and timeliness of assessment and reporting methods currently provided for in ICAO provisions and guidance material

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Action already in progress	Current	Revision of PANS-Aerodromes		
Interdependencies/References	AN-101			
Required Action				Timescales (for deliverable)
1	Develop provisions for the reporting of runway surface conditions		Proposed amendments to Annex 14 Volume 1 and other related Annexes Proposed amendments to PANS-Aerodromes and PANS-ATM	Q2/2014 Q2/2015
2	Develop guidance material for the assessment of runway surface conditions, including friction level and where contamination exists	AP/PASG	Proposed amendments to PANS-Aerodromes Proposed amendments to Doc 9137	Q2/2015 Q1/2016
3	Develop guidance material for the measurement and maintenance of runway friction	AP/PASG	Proposed amendments to PANS-Aerodromes Proposed amendments to Doc 9137	Q2/2015 Q1/2016

Development of GRF SARPs



ADOP/1
17 Member States
7 IOs



SL Replies
59 States
6 IOs



Approval by
ANC
19 Members



Adoption by Council
36 Members States



2008

Q1 2015

Q2 2015

Q1 2016

Development of GRF SARPs (cont'd)

- Proposals for the amendment of Annexes 3; 6, Parts I and II; 8; 14, Volume I; 15; PANS-Aerodromes; PANS-ATM and PANS-AIM
- State and International organizations consultation from 29 May to 28 August 2015
- 59 States and 6 international organizations replied
- Adoption of amendment during the 207th Session of the Council (February 2016)
- Effective on 11 July 2016
- **Applicable on 5 November 2020**



Friction Task Force subgroup

Regular subgroup meetings



Dec 2015 – Frankfurt

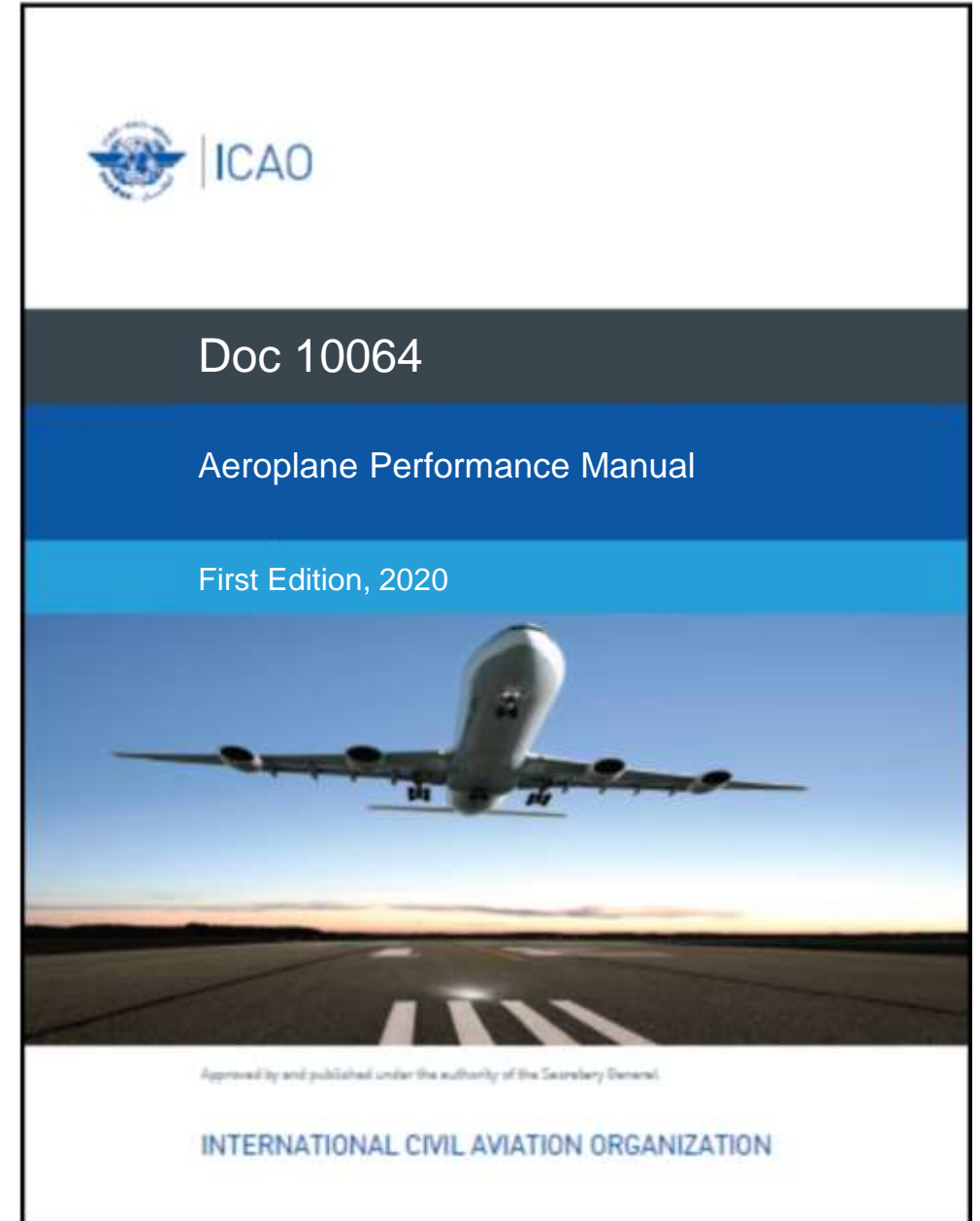
Mar 2016 – Cologne

Jun 2016 – Frankfurt

Sep 2016 – Toulouse

Feb 2017 – London

- adopted by FTF/18 in Mar 2017
- adopted by ADOP WG/3 Jul in 2017
- Master Document transferred to ICAO FLT OPS section on Aug 28, 2017
- “final” draft review July 2019
- “unedited version” publication early 2020



Methodology – Runway Condition Report (RCR)

- Designed to report runway surface condition in a standardized manner
- Common language between all actors of the system: aircraft manufacturers, aerodrome operators, aircraft operators, ANSPs, AIM, MET and other stakeholders.
- Allow flight crew to accurately determine aeroplane take-off and landing performance
- Based on the impact on aeroplane performance of the runway surface condition



Runway Condition Report

- a) **an agreed set of criteria** used in a consistent manner for runway surface condition assessment, aeroplane (performance) certification and operational performance calculation;
- b) **a unique runway condition code (RWYCC)** linking the agreed set of criteria with the aircraft landing and take-off performance table, and related to the braking action experienced and eventually reported by flight crews;
- c) **reporting of contaminant type and depth** that is relevant to take-off performance;
- d) **a standardized common terminology and phraseology** for the description of runway surface conditions that can be used by aerodrome operator inspection personnel, air traffic controllers, aircraft operators and flight crew; and
- e) **globally-harmonized procedures** for the establishment of the RWYCC with a built-in flexibility to allow for local variations to match the specific weather, infrastructure and other particular conditions.

Runway Condition Report (cont'd)

- The RCR consists of two sections:
 - aeroplane take-off and landing performance calculations; and
 - situational awareness of the surface conditions on the runway, taxiways and aprons.
- Aeroplane performance calculation section (for each runway third)
 - a one digit number identifying the runway condition code
 - the percentage coverage of the contaminant
 - the depth of loose contaminant
 - a harmonized term for runway surface condition description
- Situational awareness section (including, but not limited to): reduced runway length; presence of drifting snow, snowbanks, loose sand or chemical treatment on the runway; taxiway and apron conditions; State approved and published use of measured friction coefficient; and plain language remarks

Table II-1-3. Assigning a runway condition code (RWYCC)

Runway condition description	Runway condition code (RWYCC)
DRY	6
FROST WET (the runway surface is covered by any visible dampness or water up to and including 3 mm deep) SLUSH (up to and including 3 mm depth) DRY SNOW (up to and including 3 mm depth) WET SNOW (up to and including 3 mm depth)	5
COMPACTED SNOW (Outside air temperature minus 15 degrees Celsius and below)	4
WET ("Slippery wet" runway) DRY SNOW (more than 3 mm depth) WET SNOW (more than 3 mm depth) DRY SNOW ON TOP OF COMPACTED SNOW (any depth) WET SNOW ON TOP OF COMPACTED SNOW (any depth) COMPACTED SNOW (outside air temperature above minus 15 degrees Celsius)	3
STANDING WATER (more than 3 mm depth) SLUSH (more than 3 mm depth)	2
ICE	1
WET ICE WATER ON TOP OF COMPACTED SNOW DRY SNOW OR WET SNOW ON TOP OF ICE	0

Information String

[Aeroplane performance calculation section]

09111400 09L 3/3/2 50/50/50 NR/NR/30 COMPACTED SNOW/COMPACTED SNOW/DRY
SNOW ON TOP OF COMPACTED SNOW.

[Situational awareness section]

LDA RWY 22 REDUCED BY NOTAM TO 1150. DRIFTING SNOW. TWY B POOR.

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What Next ?

Stakeholder responsibilities

- **Aerodrome operators** assess the runway surface conditions, including contaminants, for each third of the runway length, and report them by means of a uniform runway condition report (RCR)
- **Air traffic services (ATS)** convey the information received via the RCR and/or special air-reports (AIREP) to end users (voice communications, ATIS, CPDLC)
- **Aeronautical information services (AIS)** provide the information received in the RCR to end users (SNOWTAM)
- **Aircraft operators** utilize the information in conjunction with the performance data provided by the aircraft manufacturers to determine if landing or take-off operations can be conducted safely and provide runway braking action special air-reports (AIREP)
- **Aircraft Manufacturers** provide the necessary performance data in the aeroplane flight manual

Simple Concept But Still Some Discussion Points

Up- and Downgrading at Takeoff

Treated Runways for Takeoff

Performance Assessment for Reporting by runway thirds / layered contaminants

Aircraft without data / business jets / general aviation

Wet runway reporting

Airborne phases for specific operations (short field/steep approach)

Classification of Contaminants in RCAM

- 15°C Temperature threshold on Compacted Snow

Reverser accountability



Challenges

Implementation
Training
Simultaneous Global Roll-Out
Willingness to change

Implementation task list

- Updating State's **regulatory framework**
 - updating National regulations (transposition of ICAO provisions to the national regulations)
 - filing differences / publishing significant differences in AIP (if required)
- Establishment of a **national implementation plan** that takes into account the modified ICAO provisions;
- Notification to affected aerodromes, ATS units and users of the new requirements and changes;
- **Training of inspectors** and oversight by the State of the implementation of regulations;
- Encourage the establishment of a **GRF Implementation Team** to ensure proper planning and coordination at the State and/or regional level.



What can YOU do now?

- Gather all the **information** you can from new ICAO Circular 355/Annex 14/PANS ADR/ICAO GRF Symposium presentations/ICAO Doc 10064
- Plan a National (State) event or **regional events**
- Work closely with **all stakeholders**
- Promote ACI/IATA/IFATCA/IFALPA/ZODIAC/NBAA **training courses** all of which should eventually become CBT
- **Update your AIP** before Nov 2020
- Run a parallel **test** of the GRF this coming winter
- Ensure **GA/BA and Military** are also included in the communications



Safe Landings!



Thank you