



International Civil Aviation Organization

MIDANPIRG/22 & RASG-MID/12 Meetings

(Doha, Qatar, 4 – 8 May 2025)

Agenda Item 5.3: ANS (AIM, PBN, AGA-AOP, ATM-SAR, CNS and MET)

**STANDARD DEFINITION OF WAKE TURBULENCE ENCOUNTER CLASSIFICATIONS
(LIGHT, MODERATE & SEVERE)**

(Presented by the United Arab Emirates)

SUMMARY

This paper highlights the inconsistencies in the classification and reporting of Wake Turbulence Encounters (WTE) across different airlines and Air Navigation Service Providers (ANSPs). It proposes that ICAO develop a standardized methodology for classifying wake turbulence encounters as Light, Moderate, or Severe, based on objective aircraft response metrics rather than pilot perception. The proposal aims to improve global harmonization in WTE reporting, enhance safety data reliability, and support risk mitigation strategies.

Action by the meeting is at paragraph 4.

REFERENCE

- ICAO Doc 4444 – Procedures for Air Navigation Services (PANS-ATM)
- ICAO Annex 11 – Air Traffic Services

1. INTRODUCTION

1.1 Wake turbulence encounters pose a serious safety concern, particularly during approach, departure, and enroute phases. The classification of severity is currently subjective and varies between pilots, airlines, and ANSPs.

1.2 ICAO guidance (Doc 4444, Annex 11, and PANS-ATM) lacks standardized severity criteria for wake turbulence encounters, leading to discrepancies in reporting and analysis.

1.3 Recent studies and safety data analyses conducted by international safety working groups — including ICAO experts groups such as the Wake Turbulence Specific Working Group, Eurocontrol, and airline safety departments — have shown that pilot reports alone do not provide sufficient accuracy in assessing the severity of wake turbulence encounters. These efforts, based on Flight Data Monitoring (FDM) and Quick Access Recorder (QAR) data, indicate that objective aircraft response metrics (such as roll rate, bank angle, autopilot disengagement, and vertical acceleration) offer a more reliable and consistent basis for classifying encounter severity.

1.4 This paper calls for ICAO to establish standardized classification criteria and a harmonized reporting methodology to improve the accuracy of WTE data and facilitate effective safety risk management.

2. DISCUSSION

2.1 VARIABILITY IN WAKE TURBULENCE ENCOUNTER CLASSIFICATION

2.1.1 ICAO's current separation minima mitigate wake turbulence risks but do not include clear definitions for severity levels. This results in:

- Pilot subjectivity in classifying WTEs.
- Inconsistent reporting across airlines and ANSPs.
- Difficulty in analyzing trends and implementing mitigation strategies.

2.1.2 Examples of inconsistencies:

- One pilot may report an event as Moderate, while another might classify the same event as Severe.
- Airlines use different internal severity scales, leading to reporting discrepancies.
- Safety investigations lack clear thresholds for severity assessment.

2.2 The Need for Standardized Classification Metrics

2.2.1 To address these inconsistencies, ICAO should adopt a standardized Wake Turbulence Encounter (WTE) severity classification, incorporating a proposed severity scale based on:

- Roll Angle & Altitude: Severity is linked to measured roll angles at different altitude levels.
- Aircraft Reaction: Autopilot disengagement, go-around execution, or significant control inputs indicate increased severity.
- Objective Data (QAR/FDR Analysis): Use of Flight Data Recorder (FDR) and Quick Access Recorder (QAR) metrics instead of subjective pilot perception.

Rationale: The classification criteria were developed based on a combination of operational experience, existing severity scales (such as Eurocontrol's WTE RMC Matrix), and quantifiable flight parameters (e.g., roll angle, autopilot disengagement, and vertical acceleration). These parameters were selected because they provide objective indicators of aircraft response, which are considered more reliable and consistent than subjective pilot reports. Incorporating these elements into a standardized framework allows for more accurate reporting, analysis, and safety decision-making.

2.2.2 Proposed ICAO Classification Framework:

Category	Criteria
Light WTE	Minor roll oscillation (<5°), no autopilot disengagement, minor pilot correction.
Moderate WTE	Roll oscillation (5°-20°), brief autopilot disengagement, controlled recovery.
Severe WTE	Uncontrollable roll (>20°), full autopilot disengagement, requiring immediate pilot intervention.

*See Appendix A for detailed framework:

2.2.3 A standardized Wake Turbulence Encounter Report Form should be proposed for global adoption to:

- Ensure uniform incident reporting across operators.
- Enable accurate severity classification using predefined metrics.
- Improve risk assessment and mitigation strategies.

***See Appendix B for sample reporting template:**

3. CONCLUSION

3.1 ICAO should develop standardized Wake Turbulence Encounter Severity Criteria based on aircraft response metrics rather than subjective pilot assessment.

3.2 ICAO should mandate a harmonized WTE reporting form to improve consistency and facilitate global data analysis.

3.3 The adoption of these measures will enhance safety, improve trend analysis, and support better risk mitigation strategies worldwide.

4. ACTION BY THE MEETING

4.1 The meeting is invited to:

- a) Acknowledge the need for standardized Wake Turbulence Encounter (WTE) classification criteria.
- b) invite ICAO to consider:
 - i. the development of objective severity thresholds for WTE classification taking into account the proposal in Appendix A;
 - ii. the use of a harmonized Wake Turbulence Encounter Report Form as proposed in Appendix B; and
 - iii. integrate these definitions into PANS-ATM (Doc 4444) and the Manual on Wake Turbulence Separation Minima for global consistency.

APPENDIX A

PROPOSED WAKE TURBULENCE ENCOUNTER SEVERITY SCALE MATRICES

In addition to Eurocontrol's current WTE RMC Severity Scale the risk category is also determined purely by looking at the roll experienced and at what altitude it occurred.:

Altitude	Roll Angle	Severity Classification	Importance/Reported
(\leq) 100 FT. OR BELOW	LESS THAN ($<$) 5°	Moderate	SIGNIFICANT & REPORTABLE EVENT
(\leq) 100 FT. OR BELOW	GREATER OR EQUAL TO (\geq) 5°	Severe	SIGNIFICANT & REPORTABLE EVENT
GREATER THAN ($>$) 100 FT. AND LESS THAN ($<$) 500 FT.	GREATER OR EQUAL TO (\geq) 5°	Light	NOT SIGNIFICANT & NON REPORTABLE EVENT
GREATER THAN ($>$) 100 FT. AND LESS THAN ($<$) 500 FT.	GREATER OR EQUAL TO (\geq) 5° AND LESS THAN ($<$) 10°	Moderate	SIGNIFICANT & REPORTABLE EVENT
GREATER THAN ($>$) 100 FT. AND LESS THAN ($<$) 500 FT.	GREATER OR EQUAL TO (\geq) 10°	Severe	SIGNIFICANT & REPORTABLE EVENT
FROM 500 FT. TO 800FT	LESS THAN ($<$) 10°	Light	NOT SIGNIFICANT & NON REPORTABLE EVENT
FROM 500 FT. TO 800FT	GREATER OR EQUAL TO (\geq) 10° AND LESS THAN ($<$) 25°	Moderate	SIGNIFICANT & REPORTABLE EVENT
FROM 500 FT. TO 800FT	GREATER OR EQUAL TO (\geq) 25°	Severe	SIGNIFICANT & REPORTABLE EVENT

Additional Factors:

- Where a WTE is reported and the resulting WT Separation from the Leader aircraft is equal to or greater than the ICAO eWTS minima + 3NM, then the WTE will be considered as WEAK or indeed possibly as a result of Wind Shear or Clear Air Turbulence.
- Auto-Pilot Status: Remained engaged, disengaged manually, or un-commanded disengagement.
- Event Reporting: Severity classification should be based on FDR/QAR analysis rather than subjective pilot reports.
- Mitigation Measures: Recommendations for ATCOs and pilots to enhance wake turbulence awareness and response.

APPENDIX B

PROPOSED WAKE TURBULENCE ENCOUNTER REPORT FORM

Wake Turbulence Encounter Reporting Form:

Date & Time:

- Date of incident: _____
- Time (UTC): _____

Encountering Aircraft:

- Call sign/Registration: _____
- Aircraft Type: _____
- Phase of Flight: ☐ Takeoff ☐ Climb ☐ Cruise ☐ Descent ☐ Approach ☐ Landing ☐ Holding ☐ Final ☐ Touch down ☐ Other
- Trajectory Profile: Level Flight ☐ climbing ☐ descending ☐
- IAS: _____ Heading: _____

Generator Aircraft:

- Call sign/Registration: _____
- Aircraft Type: _____
- Altitude & Heading: _____
- IAS _____ Heading: _____
- Trajectory Profile: Level Flight ☐ climbing ☐ descending ☐

Encounter Location:

- Position or Nearest waypoint: _____
- Altitude: _____
- Airport: _____

Spacing Between Aircraft:

- Relative trajectory of aircraft involved: in-trail ☐ parallel ☐ opposite ☐ crossing ☐
- Vertical separation: _____
- Longitudinal/Horizontal separation: _____
- Applicable separation minima (longitudinal & Vertical): _____

Weather Conditions:

- Wind direction/speed: _____
- Visibility: _____
- Temperature: _____
- Dew Point: _____

Pilot-Reported Severity:

- Pilot reported severity as: ☐ Light ☐ Moderate ☐ Severe
- Roll: _____
- Auto Pilot: remained engaged ☐ disengaged un-commanded ☐ disengaged manually ☐

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Description of Event or any additional information related to the WTE:

- END -