



ASSEMBLY — 41ST SESSION

TECHNICAL COMMISSION

Agenda Item 31: Aviation Safety and Air Navigation Standardization

RECOMMENDATIONS ON THE DEVELOPMENT OF APPLICABLE IN-FLIGHT
TURBULENCE STANDARDS

(Presented by China)

EXECUTIVE SUMMARY

In-flight turbulence level categorization by ICAO cannot accurately reflect the turbulence of different aircraft types, making it difficult for the crew to make correct response. This paper proposes that applicable in-flight turbulence standards be developed for different aircraft types.

Action: The Assembly is invited to recommend that ICAO, Member States, and the industry work together to develop applicable in-flight turbulence standards.

<i>Strategic Objectives:</i>	This working paper relates to Safety Strategic Objectives. .
<i>Financial implications:</i>	The activities referred to in this paper will be undertaken with resources available in the 2022-2025 Regular Programme Budget.
<i>References:</i>	Annex 3 — <i>Meteorological Services for International Air Navigation</i>

¹ English and Chinese versions provided by China.

1. BACKGROUND

1.1 According to the statistical results on FAA's official website², in nonfatal accidents, in-flight turbulence is the leading cause of injuries to airline passengers and flight attendants. In addition, turbulence also causes aircraft downtime for maintenance, flight delays and other impacts, bringing substantial economic losses to the airlines. Statistics from Civil Aviation Administration of China (CAAC) show that more than 1,700 turbulence events occurred from 2017 to 2021.

1.2 As indicated in 2.6 of ICAO Annex 3 — *Meteorological Services for International Air Navigation*, the turbulence shall be reported in terms of the cube root of the eddy dissipation rate (EDR). Turbulence can be classified as light (0.1-0.4), moderate (0.4-0.7) and severe (>0.7) in intensity based on the peak value of the cube root of EDR.

1.3 The EDR is an aircraft-independent measure of turbulence, and is therefore not a function of parameters such as aircraft type, mass and airspeed.

2. INTRODUCTION

2.1 For the same EDR value, crew members have different perceptions while flying different aircraft types. Crew perceptions can be described by aircraft load (G). According to the *Flight Crew Operations Manual*, crew members usually base their judgement of aircraft performance such as flight envelope and maneuvering margin on aircraft load and make corresponding response. The relationship between EDR and aircraft load, once established, can be used to convert the forecasted weather turbulence into crew perception.

2.2 CAAC has carried out a research on the conversion equation between EDR and G using QAR data, which is feasible, as shown by the results.

2.3 CAAC has conducted a research on the development of applicable in-flight turbulence standards based on the turbulence index. Airlines can convert the turbulence forecast described by EDR from aviation weather service providers into the aircraft load which is used to convert to turbulence index. During conversion, the decile of "vertical load value minus 1", represented by 0-9, will be chosen. The research has led to a draft standard that addresses the means and procedures available for pilots, flight attendants and dispatchers to deal with turbulence and the training requirements for the three types of personnel.

2.4 The draft applicable in-flight turbulence standard has been verified and tested by an airline in China. As of now, verification of 770 flights and 850 crew members has been conducted, with an accuracy rate of over 82% based on the crew feedback. From October 2021, this draft standard has been embedded into Cloud-based Pilot License APP to serve the pilots across China.

² https://www.faa.gov/travelers/fly_safe/turbulence/

3. **DISCUSSION**

3.1 ICAO's current in-flight turbulence level categorization cannot accurately reflect crew's perception for the same EDR value on different aircraft types, making it difficult for the crew to make correct response based on their perception. It is recommended to conduct a research on the development of applicable in-flight turbulence standards.

3.2 Applicable In-flight Turbulence Standard

3.2.1 Applicable in-flight turbulence standard extends the current standard and uses a turbulence index to represent the turbulence intensity. Turbulence index can be the result of a conversion using the forecast EDR and the EDR-G conversion equation for the aircraft concerned.

3.2.2 It is recommended that turbulence intensity levels be classified as light (0-2), light to moderate (3-4), moderate (5-6), and severe (>6) based on the turbulence index, and that responses be developed for each turbulence level.

4. **CONCLUSION**

4.1 The Assembly is invited to recommend that ICAO, Member States, and the industry work together to develop applicable in-flight turbulence standards.

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