



**WORKING PAPER**

**FOURTEENTH AIR NAVIGATION CONFERENCE**

**Montréal, Canada, 26 August to 6 September 2024**

- Agenda Item 2: Timely and safe use of new technologies**  
**2.3: 2026-2028 Edition of the Global Aviation Safety Plan (GASP)**

**IMPROVING GLOBAL TURBULENCE RISK MONITORING**

(Presented by the Republic of Korea)

**EXECUTIVE SUMMARY**

This paper presents a proposal by the Republic of Korea to improve turbulence related risk monitoring by collecting, analysing, and utilizing turbulence data. It emphasizes the need for turbulence-related information sharing and seeks ICAO's support and promotion of international cooperation for effective turbulence risk management.

Action: The Conference is invited to agree to Recommendation 2.3/x in paragraph 3.

**1. INTRODUCTION**

1.1 Considering recent trends in accidents and serious incidents, the Republic of Korea highly values the inclusion of turbulence encounters (TURB) as a global operational safety risk in the 2026-2028 *Global Aviation Safety Plan* (GASP, Doc 10004). Turbulence encounters (TURB) may not pose a high fatality risk, but they are prominently featured among the most frequent types of accidents and serious incidents across ICAO regions. This paper aims to propose actions by Member States and ICAO to ensure the effective implementation of monitoring measures for global operational safety risks.

**2. DISCUSSION**

2.1 Studies on turbulence indicate that climate change impacts upper atmospheric turbulence, revealing an increase in turbulence due to various factors<sup>1</sup>. Analyses of climatological changes in turbulence in the upper troposphere and lower stratosphere of the Northern Hemisphere confirm an increase in both the frequency and intensity of turbulence due to climate change<sup>2</sup>. Such turbulence poses a significant threat

<sup>1</sup> Kim, S.-H., J. Kim, J.-H. Kim\*, and H.-Y. Chun, 2022: Characteristics of the Derived Energy Dissipation Rate using the 1-Hz Commercial Aircraft Quick Access Recorder (QAR) Data. *Atmos. Meas. Tech.*, 15, 2277-2298

<sup>2</sup> Lee, J. H., Kim, J.-H.\*, Sharman, R. D., Kim, J., & Son, S.-W. (2023). Climatological of Clear-Air Turbulence in upper troposphere and lower stratosphere in the Northern Hemisphere using ERA5 reanalysis data. *Journal of Geophysical Research: Atmospheres*, 128, e2022JD037679.

to the safety of passengers and crews, increasing aircraft structural stress and fatigue, which can result in higher maintenance frequencies, increased maintenance costs, and reduced aircraft lifespan. Additionally, turbulence encounters disturb optimal altitude operations, potentially delaying the achievement of the long-term aspirational goal (LTAG).

2.2 Historically, ICAO and the international community have focused relatively more on safety risk factors such as human factors, system component failures and aerodrome which are recognized to be manageable. However, safety risks from meteorological phenomena like turbulence are perceived as natural occurrences, making them more challenging to predict and respond to compared to risks factors mentioned above. Despite this inherent challenge, technological advancements now enable active responses to these meteorological risks.

2.3 Republic of Korea recognizes increasing global trend of aircraft accidents caused by turbulence. In case of Republic of Korea, over the past decade, around 40 per cent of accidents involving the Republic of Korea's commercial aircraft operators were caused by turbulence encounters. Since 2019, the Republic of Korea has identified turbulence encounters as one of the key safety risk areas in its State safety programme (SSP). The Republic of Korea has been recommending various measures for preventing turbulence injuries to aircraft operators, conducting public campaigns on cabin safety, and enhancing pilot-controller communication and training.

2.4 Despite these efforts, turbulence-related risks persisted. Therefore, since 2022, the Republic of Korea has initiated a project to establish a "Public Adverse Weather Dashboard" through collaborations with the public and private sectors. This dashboard aims for three purposes;

- a) to improve the accuracy of weather prediction models by meteorological authorities;
- b) to enable strategic responses to aircraft operators' turbulence such as flight planning;  
and
- c) to facilitate tactical responses to aircraft operators' turbulence such as real-time altitude changes or detouring to avoid turbulence.

2.5 During the project to establish the "Public Adverse Weather Dashboard", the Republic of Korea is putting effort to collect various types of data related to significant weather issues, however, is facing some difficulties due to coordination issues internally and externally. Annex 3 – *Meteorological Service for International Air Navigation* requires aircraft operators to report turbulence intensity using eddy dissipation rate (EDR) when air-ground datalink is used, and these reports (air-reports) should be transmitted to meteorological offices without delay.

2.6 ICAO and the international community now are requested to recognize turbulence data like EDR as important safety data to establish measures to mitigate turbulence risks, which have become a global operational safety concern. Active sharing and exchange of such data and safety information among aircraft operators, air traffic service units, meteorological authorities, and aviation safety authorities are necessary. Furthermore, cross-border information sharing should be promoted.

2.7 The Republic of Korea recommends ICAO to make initiatives to actively support Member States in collecting, analysing, and monitoring such safety data for safety improvement purposes. Additionally, the Republic of Korea suggests that Member States clearly understand turbulence-related occurrences in accordance with Annex 13 – *Aircraft Accident and Incident Investigation*, actively report related accidents and serious incidents to ICAO, and promote a reporting culture among aircraft operators, air traffic service units, and meteorological authorities in accordance with the requirements in Annex 3 and Annex 11 – *Air Traffic Services*.

### 3. CONCLUSION

3.1 The global efforts mentioned above will enhance the accuracy of turbulence forecasts, enabling Member States' aircraft operators to strategically and tactically respond to turbulence-related risks. Considering the points discussed, accordingly, the Conference is invited to agree to the following recommendation:

#### **Recommendation 2.3/x – Turbulence risk monitoring**

That States:

- a) clearly understand turbulence-related occurrences in accordance with Annex 13 – *Aircraft Accident and Incident Investigation* and actively report related accidents and serious incidents to ICAO; and
- b) promote a reporting culture among aircraft operators, air traffic services units, and meteorological authorities in accordance with the requirements in Annex 3 – *Meteorological Service for International Air Navigation* and Annex 11 – *Air Traffic Services*;

that ICAO:

- c) continuously monitor turbulence safety risks and update GASP and annual Safety Reports accordingly;
- d) establish mechanisms for cooperation and support among Member States, international organizations, and industries to facilitate the collection and sharing of meteorological observation data related to turbulence; and
- e) develop mechanisms for cross-border meteorological data sharing and exchange to support the improvement of the accuracy of weather forecasts by meteorological authorities.

— END —