

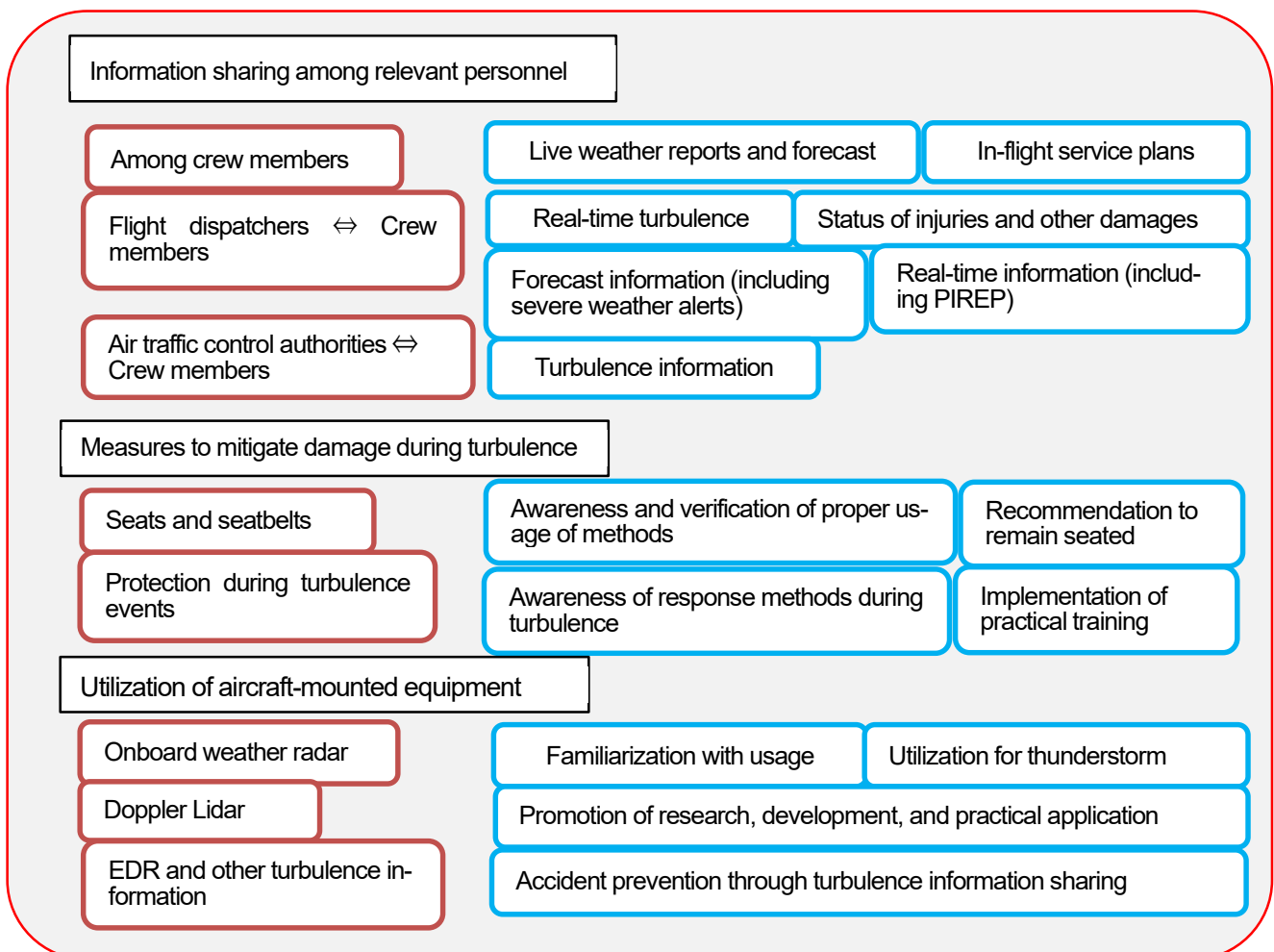
## Chapter 5 Summary

### Occurrence of aircraft turbulence-related accidents

- From 2004 to 2023, there were 67 accidents involving large aircraft, with more than half (37 cases) classified as turbulence-related accidents.
- The leading cause of turbulence-related accidents was in-cloud turbulence (over one-third of cases), followed by clear-air turbulence (also one-third).
- The number of seriously injured passengers has been decreasing, whereas the number of injured cabin crew has been increasing.
- Most passenger injuries occurred while the seatbelt sign was ON, whereas approximately 70% of cabin crew injuries occurred while the seatbelt sign was OFF.
- About 80% of in-cabin injuries occurred in the rear section of the aircraft, with no significant differences observed based on aircraft size.
- Perception of turbulence differs between the cockpit and the cabin: in the cockpit, approximately 40% of cases were reported as "mild or less," whereas in the cabin, turbulence was almost always perceived as "strong."
- Changes in vertical acceleration during accidents exceeded 1.0G in over 80% of cases, though some cases were below 1.0G.
- About half of the flight crew were unaware of the possibility of severe turbulence, including before takeoff.
- One-third of cases showed insufficient information sharing among crew members or between crew and flight dispatchers.

### Towards recurrence prevention (proactive measures)

The key points for accident prevention, derived from past accident data and case studies, are as follows: "Turbulence prediction" and "Response to turbulence" must be carried out in a timely and appropriate manner.



## Message from the head of accident prevention analysis office

Preventing turbulence-related accidents caused by natural phenomena such as turbulence is inherently difficult, and until new technologies are fully implemented, the only option is to continue with the current accident prevention (damage mitigation) measures appropriately.

Furthermore, aside from the development of new technologies, the recurrence prevention measures outlined in Chapter 4 are largely consistent with the measures that the Civil Aviation Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) has repeatedly requested airlines to implement in the past. This underscores the challenge of preventing turbulence-related accidents in advance.

That being said, we cannot afford to remain passive. Even though predicting and detecting turbulence remains challenging, continued research and development must aim to improve the accuracy of turbulence forecasts and enable the real-time sharing of turbulence conditions.

Furthermore, since aircraft are designed with turbulence in mind, it is naturally expected that passengers always fasten their seatbelts low and tight around their waist, even while seated. Additionally, using the restroom as much as possible while on the ground and ensuring that all passengers are aware of turbulence safety measures can significantly reduce injuries and prevent accidents. Preventing turbulence-related accidents requires not only the efforts of airline operators but also the cooperation of passengers. We hope for your understanding in this matter.

Moreover, airlines should take a step back and reconsider the fundamental purpose of air transportation—which is to safely transport people and goods. Given the increasing number of injuries among cabin crew, it is crucial to ensure that prioritizing passenger service does not inadvertently lead to accidents. It may also be necessary to establish clear company policies, such as ensuring that cabin crew remain seated as a basic rule and suspending in-flight services when significant turbulence is expected. This would help create a psychologically safe environment for crew members when making decisions that may require prioritizing safety over service, rather than leaving such decisions solely to on-the-spot judgment.

We hope this digest serves as an opportunity for all airline operators to reflect on their commitment to safety.

Finally, in preparing this digest, we received valuable contributions through interviews and column submissions from ANA, JAL, and JAXA. Their insights allowed us to include important information about their respective initiatives. We sincerely appreciate their cooperation.

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