



WORKING PAPER

**DANGEROUS GOODS PANEL (DGP)
WORKING GROUP MEETING (DGP-WG/23)**

Rio de Janeiro, Brazil, 15 to 19 May 2023

Agenda Item 1: Harmonizing ICAO dangerous goods provisions with UN Recommendations on the Transport of Dangerous Goods (REC-A-DGS-2025)

1.1: Develop proposals, if necessary, for amendments to Annex 18 — *The Safe Transport of Dangerous Goods by Air*

ADDRESSING INCONSISTENCIES IN ANNEX 18 AND THE TECHNICAL INSTRUCTIONS

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SUMMARY

This working paper seeks to measure Dangerous Goods Panel (DGP) interest in discussing inconsistencies within Annex 18 — *The Safe Transport of Dangerous Goods by Air* and the Technical Instructions, between those documents and other Annexes, and between dangerous goods provisions and current operational procedures in use by airlines and flight crews.

Action by the DGP-WG is in paragraph 2.

1. INTRODUCTION

1.1 It is possible that some elements of the international regulatory structure for the transport of dangerous goods were established in the 1940's, well before the age of jet transport. The *Technical Instructions for the Safe Transport of Dangerous Goods by Air* (Doc 9284) were first published nearly 40 years ago in 1984. This structure has provided a legal framework with a largely excellent safety record for the global movement of dangerous goods by air for almost four decades. However, the current system has some inconsistencies and inefficiencies, particularly in regulating manufactured articles. The rapid change in the international air transport system and the increase in type, quantity, and complexity of dangerous goods carried by air has made it more difficult to regulate to a consistent level of safety between types of dangerous goods and types of flight operations.

1.2 An integrated systems approach is needed to ensure safety and avoid unintended lapses. This means considering dangerous goods, airworthiness, and operations regulations as a system, rather than separately. The growing complexity of dangerous goods and risk mitigation means a one-size-fits-all

regulatory structure is no longer sufficient and a performance-based system is needed as recognized by the risk assessment requirement of Annex 6 — *Operation of Aircraft, Part I — International Commercial Air Transport — Aeroplanes*, Chapter 15. This system should match the nature of dangerous goods with the safety capabilities of the aircraft and the operator, leading to safer and more efficient operations. Performance-based standards and safety management can provide a high level of safety with greater flexibility than prescriptive provisions.

1.3 The current provisions appear to regulate different materials and articles to different levels of safety, sometimes leaving gaps in the safety structure. While materials often have a very defined hazard (e.g. flashpoint, radioactivity level), manufactured articles with a common UN number can have very different risks associated with them (consider the wide variety of items included in UN 3171 or UN 3481).

1.4 There have been profound changes in aviation, technology, and international supply chains during the 80 years since some of the first dangerous goods handling practices were developed, and here we note some of the inconsistencies that have developed in Annex 18 and the Technical Instructions:

- a) **Lack of one level of safety for all types and quantities of dangerous goods.** Target safety levels of regulation should be consistent and clearly stated. Currently, ICAO offers two definitions for the accepted risk level for carrying dangerous goods. The first states that dangerous goods should be carried without placing an aircraft or its occupants at risk. The second states that should an incident occur, it cannot lead to an accident. Currently, however, various materials and articles are regulated to different levels of safety. For example, explosives and flammable liquids need an external initiator to become dangerous. With very few exceptions, explosives allowed on aircraft are regulated so that any dangerous propagation reactions are prevented, and effects produced by ignition during transport are contained. Flammable liquid fires are largely suppressible by today's fire suppression systems. Additionally, these cannot self-ignite and are packaged to prevent flammable material from escaping the packaging and contacting an ignition source. Some mining machines shipped as Class 7, Radioactive, are safe enough to be used by workers in the field without radiation protection, but still must be shipped in containers that prevent radioactive material escape in case of a depressurization. At the same time, lithium batteries can be self-initiating and self-propagating and can be shipped in a way that a single battery or cell failure can overwhelm aircraft safety systems and lead to the loss of an aircraft. These provisions appear to lack a consistent targeted level of safety.
- b) **One Level of Safety for All Types of Operations (Passenger and Cargo).** Type and quantity limits of DG allowed in air transport are based on whether it is carried on passenger or cargo aircraft. The reason given in the Technical Instructions is not to allow for two different levels of safety between passenger and all-cargo operations, but because cargo flight crews are assumed to have a wider range of options available in the event of a dangerous goods incident. This is stated under General Principles in the Foreword of the Technical Instructions which explain that "Dangerous goods restricted to cargo aircraft are either in larger quantities or forbidden on passenger aircraft, and their transport is allowed due to their accessibility in flight and the ability of the flight crew to take a wider range of actions in an emergency." In fact, the Technical Instructions require many dangerous goods shipments not allowed on passenger aircraft to be accessible in flight for this very reason.

Basing type and quantity limitations on the type of operations has been a fundamental principle in the Technical Instructions since their inception, but the nature of cargo and aircraft has changed significantly since then. The requirement for accessibility of dangerous goods in the Technical Instructions may have had real safety benefits at one time, but today's aircraft cargo compartments are either not accessible in flight (Class C and belly Class E) or there are no personnel allocated to access the cargo in the event of a dangerous goods incident (main deck Class E). Almost all aircraft used in international commerce are designed for two pilots as the entire cockpit crew, and during an inflight emergency, both pilots are needed to fly the aircraft, accomplish emergency checklists, and prepare for what might be an emergency landing. Therefore, accessibility of dangerous goods on modern aircraft provides no reliable safety benefit.

Not all aircraft have the same approved means of fire suppression. Aircraft whose primary purpose is carrying passengers normally have Class C underfloor compartment fire protection, while freighters normally have Class E main deck systems and a mix of Class E and C underfloor. But even when a passenger aircraft and an all-cargo aircraft have identical fire suppression systems and capabilities (e.g. inaccessible Class C belly compartments), the dangerous goods allowed as cargo is different because of the arbitrary definition of passenger and freighter aircraft. In the case of a fire in a Class C compartment, pilots of a cargo aircraft have the exact same means of fire suppression as the pilots of a passenger aircraft, yet the allowed cargo in the compartment is vastly different.

The determining factor for allowing different types and quantities of dangerous goods for different operations should be the risk profile and mitigating strategies used by the operators and capabilities of the aircraft, not simply a higher safety standard for one type of operation.

One level of safety can be achieved with a performance-based system where operators consider the entire aircraft as a system, including the certified safety systems and supplemental features, such as fire-resistant containers, fire resistant pallet covers, main deck active suppression systems, and various cargo screening and acceptance methods.

- c) **Ensure Dangerous Goods Provisions are Consistent with Other Annexes.** As has been noted by the International Coordinating Council of Aerospace Industries Associations (ICCAIA), the safety features of current commercial aircraft are not designed to necessarily mitigate risks from dangerous goods in cargo. The dangerous goods provisions regulate at the package level. With the current system, it would be logical to assume that the dangerous goods regulatory system reduces the risk of a package to that which was assumed when the existing airworthiness and flight operations provisions were developed. Therefore, one might assume that the dangerous goods system produces packages with the same risk as general cargo. This is no longer the case with the increasing quantity and complexity of Dangerous Goods being transported. The Annex 6, Chapter 15 risk assessment requirement is a recognition of this development.
- d) **Effectiveness of Annex 6, Chapter 15 risk assessment.** The Annex 6, Chapter 15 risk assessment requirement was developed to plug significant safety gaps that

existed between various ICAO Annexes, and the importance to flight safety of conducting this assessment properly is significant. We have heard at various venues that some airlines are having a very difficult time assessing the risks from transporting dangerous goods, and that in many cases, prescriptive regulations would facilitate their operations.

2. ACTION BY THE DGP-WG

2.1 The DGP-WG is invited to discuss if there is interest in a process to:

- a) reconcile the statements in the General Principles section of Annex 18 and the Foreword of the Technical Instructions with today's aviation system and its operating procedures;
- b) discuss a path to ensure each type of dangerous good is regulated to the same level of safety consistent with existing airworthiness and flight operations provisions.
- c) develop a performance-based dangerous goods regulatory system based on aircraft and operational capability rather than type of operation being conducted.
- d) Consider whether there is a way to develop different levels of dangerous goods certification to allow carriers who are not able to carry out risk assessments to accept limited types and quantities of dangerous goods in a prescriptive structure, while more sophisticated operators could use the Annex 6 cargo compartment risk assessment to extend their capabilities.

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