



WORKING PAPER

FOURTEENTH AIR NAVIGATION CONFERENCE

Montréal, Canada, 26 August to 6 September 2024

- Agenda Item 2: Timely and safe use of new technologies**
2.2: Addressing safety risks related to evolving aviation technologies

**MANAGING SAFETY RISKS DERIVED FROM HAZARDOUS LIGHTS
IN EVOLVING AIRPORT ENVIRONMENTS**

(Presented by the Republic of Korea)

EXECUTIVE SUMMARY

This paper highlights the need to develop strategies for the assessment and management of hazardous lights in evolving airport environments to enhance aviation safety and sustainability. As airports transform into multifunctional complexes, including logistics hubs, resorts, cultural tourism centres, and global trade and production bases, there is a growing necessity to manage the safety risks derived from lightings. Implementing comprehensive strategies can significantly reduce the risks associated with high-intensity light emitting diode (LED) lights, digital displays, and renewable energy structures, ensuring the safety of aerodrome traffic. This working paper proposes that Member States engage in collective efforts to address these challenges, and that ICAO develop and implement international policies and best practices for managing the safety risk associated with hazardous lights.

Action: The Conference is invited to:

- a) encourage Member States in coordination with industries to engage in collective efforts to address the challenges posed by hazardous lights; and
- b) recommend that ICAO develop and implement international policies and best practices for managing the risks associated with hazardous lights through strong policy directives and coordinated actions, ensuring alignment with the broader goals of aviation safety and sustainability.

1. INTRODUCTION

1.1 As airports evolve into multifunctional complexes incorporating logistics hubs, resorts, cultural tourism centres, and global trade and production bases, there is an increasing need to address the safety risks posed by new lighting technologies. High-intensity LED lights, digital displays, and renewable energy structures such as solar panels are becoming more prevalent around aerodromes, presenting new challenges for aviation safety. These changes necessitate the development of comprehensive strategies for the risk assessment and management of hazardous lights.

2. DISCUSSION

2.1 According to Annex 14 — *Aerodromes*, Standard 5.3.1.1, lights that may endanger the safety of aircraft must be extinguished, screened, or otherwise modified to eliminate the source of danger. Similarly, Annex 14, Recommendation 5.3.1.3 emphasizes that lights which may cause confusion should be modified to eliminate such risks. These provisions highlight the importance of managing lighting hazards to ensure safe flight operations. Additionally, the rapid evolution in aviation technologies, such as the development of advanced aircraft systems and automation, necessitates updated strategies to manage these lighting hazards.

2.2 To effectively address the challenges posed by hazardous lights, it is essential to develop and implement comprehensive strategies that consider the dynamic and evolving nature of airport environments. This includes staying abreast of technological advancements and operational practices.

Flight Safety Hazard: The “Glare” Phenomenon

2.3 The presence of high-intensity direct, indirect, or reflected light can cause a phenomenon known as “glare”. This can significantly impact flight safety by reducing pilot’s ability to recognize objects or by causing discomfort. The potential sources of glare include high-intensity LED lights, digital displays, and renewable energy structures such as solar panels, which are increasingly common in and around aerodromes. As airports continue to evolve into multifunctional complexes, managing these lighting hazards becomes increasingly critical to ensure both safety and sustainability, especially in light of new aviation technologies that demand more precise and clear visibility conditions.

Assessment Criteria for Sustainability and Safety

2.4 In the context of the theme “Performance Improvement Driving Sustainability”, and addressing the safety risks posed by evolving aviation technologies, a comprehensive risk assessment methodology has been developed by the Republic of Korea that utilizes three key criteria:

- a) **Disabling Glare:** This criterion assesses the intensity of glare that can impair a pilot’s vision, using a quantitative value of luminance (cd/m^2). Disabling glare is a phenomenon where light scattering inside the eye causes the image on the retina to be lost, significantly affecting visual performance.
- b) **Object Recognition:** This criterion evaluates the ability to distinguish an object from its background. It is assessed by the degree of change in object recognition according to the disability glare index. Factors such as the luminance of aeronautical lights and the background play a crucial role in this evaluation.
- c) **Identification Interference:** This criterion expresses the degree to which glare interferes with identifying the target object under reduced object recognition conditions. It considers the luminance of the object and background, as well as the angle formed by the line connecting the light source and the eye.

Methodology Implementation

2.5 The risk assessment results will be categorized into three levels: Intolerable, Tolerable and Acceptable, based on the safety risk matrix in line with the *Safety Management Manual* (Doc 9859). This categorization allows for a structured approach to managing and mitigating risks associated with hazardous lights, ensuring that performance improvement initiatives are in line with sustainability goals.

Validation and Expert Committee

2.6 To ensure the reliability and accuracy of the risk assessment methodology, validating the results of the risk assessments by an expert group is necessary to ensure that they are consistent with the latest technological advancements and operational practices. This expert group includes representatives from various relevant fields, including aviation safety, lighting technology and human factors.

Future Considerations

2.7 As aviation technology and infrastructure continue to evolve, it is essential to continuously update and refine the risk assessment methodologies. Future considerations should include advancements in lighting technology, changes in airport design and emerging trends in aviation operations. Ongoing research and collaboration with international experts will be necessary to keep the guidelines relevant and effective, contributing to the overall objective of performance improvement driving sustainability.

3. CONCLUSION

3.1 The Republic of Korea suggests Member States in coordination with industries worldwide to engage in collective efforts to address the emerging challenges posed by hazardous lights. The proliferation of high-intensity LED lights, digital displays, and renewable energy structures such as solar panels near aerodromes necessitates robust strategies for assessing and mitigating the associated risks.

3.2 The Republic of Korea invites ICAO to collaborate with Member States, industry leaders, and subject matter experts to develop and implement international guidelines and best practices for managing the safety risks associated with hazardous lights. These efforts should aim to ensure that the guidelines are practical, effective, and aligned with the broader goals of aviation safety and sustainability, including clear directives and coordinated actions.

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