BRIEFING LEAFLET

26HUPBL02
17 November 2026

Occupational Exposure to Ultraviolet (UV) Radiation and Blue Light in Flight Operations

NOTE

This paper supersedes 24HUPBL01.

1. INTRODUCTION

Flight crew operate in an environment where altitude and reflected sunlight may increase exposure to ultraviolet (UV) radiation. While flight deck windscreens block UV-B radiation, UV-A transmission varies between aircraft types. This briefing leaflet expands previous IFALPA guidance by considering UV exposure as an occupational health issue affecting both ocular and skin health.

2. UV RADIATION IN THE AVIATION ENVIRONMENT

Ultraviolet radiation occupies wavelengths between 100 and 400 nm and is divided into UV-A (315–400 nm), UV-B (280–315 nm), and UV-C (100–280 nm). UV-C is absorbed by the atmosphere and is not encountered during normal flight operations. Flight deck glazing blocks essentially all UV-B, whereas UV-A transmission varies by aircraft type and even by window location within the same aircraft.

Exposure to UV-A-radiation increases with altitude, by approximately 10–15% per 1,000 meters because the atmosphere provides less attenuation of solar radiation. Additional intensity arises near the equator and the poles, due to stratospheric ozone thinning. Reflections from cloud tops, snow, or water can further amplify exposure levels. Flights conducted above extensive cloud layers may therefore expose crews to greater reflected solar radiation than similar flights below cloud.

As a result, pilots are often consistently exposed to significant levels of UV-A radiation during flight.

3. OCCUPATIONAL EXPOSURE OF FLIGHT CREW

Commercial pilots accumulate solar exposure over many years through repeated flight operations. Exposure is influenced by aircraft type, route structure, duty schedules, flight deck orientation and the availability and use of effective sunshades.

Occupational exposure should therefore be considered cumulatively rather than on a single-flight basis. While leisure sun exposure remains an important contributor to lifetime UV dose, occupational exposure represents an additional factor that operators should consider within their occupational health and safety programmes.

A precautionary risk-management approach is appropriate: where flight deck UV protection characteristics are unknown or variable, engineering controls, operational procedures and personal protective measures should be combined to minimise unnecessary exposure while maintaining safe flight operations.

4. HEALTH EFFECTS

Solar ultraviolet radiation has well-established biological effects on both the eyes and skin. Historically, UV-B and UV-C have been considered the most harmful wavelengths, with UV-B being the primary contributor to the adverse health effects of UV radiation. However, accumulating evidence highlights growing concerns about the harmful effects of UV-A radiation.

4.1 Ocular Hazards

The anterior structures of the eye absorb most ultraviolet radiation, protecting the retina from direct UV injury. Consequently, cataract formation represents the ocular condition with the strongest evidence of an association with chronic UV exposure. Epidemiological studies have identified UV radiation as one of several recognised risk factors for cataracts, together with age, smoking, diabetes, steroid medication, and genetic predisposition.

Acute exposure to intense ultraviolet radiation may cause photokeratitis and photoconjunctivitis. These conditions usually occur after exposure to highly reflective environments such as snow or water or following artificial sources such as welding arcs. Typical flight deck exposure during routine operations is unlikely to produce photokeratitis, although reflected sunlight above cloud layers may increase exposure.

Blue light has attracted increasing attention because of its potential role in retinal photochemical injury and age-related macular degeneration. Current evidence remains inconclusive and studies have not demonstrated a clear benefit of blue-light filtering lenses in preventing retinal disease. Pilots should therefore continue to use high-quality UV-protective sunglasses primarily for protection against ultraviolet radiation.

4.2 Skin Hazards

Ultraviolet radiation is a well-established cause of skin damage. UV-B radiation is the primary cause of sunburn and a major contributor to photoaging and the development of both melanoma and non-melanoma skin cancers. Although UV-A has lower energy than UV-B, it penetrates more deeply into the skin and contributes to premature skin ageing. Increasing evidence from experimental studies and animal models also suggests that UV-A may play a role in melanoma development, (Fadadu et al., 2022; Gallagher et al., 2010; Moan et al., 2012; Setlow et al., 1993).

Several epidemiological studies have reported an increased incidence of actinic keratosis, basal cell carcinoma and melanoma among airline pilots (Sanlorenzo et al., 2015; Hammer et al., 2014; Scheibler et al., 2022). Similar findings have also been reported among cabin crew, despite their lower direct occupational exposure to flight deck UV radiation. These observations suggest that the increased skin cancer risk in aircrew is likely multifactorial, involving occupational UV exposure together with other occupational and non-occupational factors. Consequently, the specific contribution of flight deck UV-A exposure to melanoma risk has not yet been fully established.

Individual susceptibility varies considerably and is influenced by factors including skin type, cumulative lifetime UV exposure, history of sunburn, age, family history, and immune status. Occupational exposure during flight should therefore be considered as one component of an individual's overall lifetime ultraviolet exposure.

4.3 Occupational Health Considerations

The available scientific evidence supports a precautionary approach to occupational UV exposure in aviation. While some flight deck measurement studies have reported relatively low UV-A transmission and others have measured higher exposures, there is broad agreement that unnecessary exposure should be reduced wherever reasonably practicable. Engineering controls remain the preferred means of protection, supplemented by operational procedures, appropriate use of flight deck sunshades, and personal protective measures. Incorporating UV awareness into occupational health programmes and encouraging regular ophthalmological and dermatological examinations may assist in early identification of UV-related disease.

5. FACTORS INFLUENCING EXPOSURE

The level of ultraviolet radiation encountered during flight is influenced by numerous operational and environmental factors. No single flight profile determines exposure; rather, cumulative dose depends on the interaction of several variables over a pilot's career.

Factor	Influence on UV Exposure
Altitude	UV intensity generally increases with altitude because less atmosphere is available to absorb solar radiation.
Latitude and season	Solar elevation, seasonal changes, and ozone distribution influence UV intensity.
Cloud, snow, and water	Reflection from cloud tops, snow, and water may substantially increase exposure.
Aircraft type	Flight deck glazing characteristics differ between aircraft types and window locations, influencing UV-A transmission.
Flight duration	Long daylight sectors increase cumulative occupational exposure.
Flight deck shading	Effective use of sun visors and shades reduces direct exposure.

6. PROTECTIVE MEASURES

The preferred strategy for controlling occupational UV exposure follows the hierarchy of controls. Engineering solutions should be prioritised wherever practicable, with administrative measures and personal protection providing additional risk reduction.

6.1 Engineering Controls

UV-A absorption should be in the A/C certification criteria. The UV-A blocking specifications are often not disclosed by manufacturers, making it difficult to assess actual exposure levels. Where glazing performance is uncertain, operators should seek manufacturer information or appropriate measurements. Flight deck sunshades should permit effective shielding from direct sunlight without compromising safety.

6.2 Administrative Controls

Operators should incorporate UV exposure into occupational health risk assessments and provide flight crew with education on UV hazards and effective protective strategies. Consideration should be given to UV exposure during aircraft procurement, operational procedures and occupational health surveillance.

6.3 Personal Protection

Pilots should wear high-quality sunglasses providing 99–100% UV-A and UV-B protection without degrading visual acuity or colour discrimination. Long-sleeved clothing, sunscreen on exposed skin and appropriate use of flight deck shades provide additional protection.

7. RECOMMENDATIONS

7.1 Flight Crew

- Wear sunglasses providing **99–100% UV-A and UV-B protection (UV400)** with high optical quality and without impairing colour discrimination or visual acuity.
- Use flight deck sun visors and shading devices whenever operationally appropriate to minimise direct solar exposure.
- Apply broad-spectrum sunscreen (SPF 30 or higher) to exposed skin and consider long-sleeved clothing during prolonged daylight exposure.
- Report defective flight deck shading equipment through the operator's safety reporting system.
- Seek medical advice for persistent visual symptoms or suspicious skin lesions, and participate in regular ophthalmological and dermatological examinations where available.

7.2 Operators

Operators should recognise ultraviolet radiation as a potential occupational hazard within their occupational health and safety management systems. Where appropriate, UV exposure should be included in occupational risk assessments, taking into account aircraft type, operating environment, and flight profile.

Operators should:

- provide flight crew with education on UV radiation, associated health risks, and effective protective measures;
- ensure flight deck shading equipment is maintained in a serviceable condition;
- encourage participation in occupational health programmes, including regular ophthalmological and dermatological examinations; and
- consider UV protection when evaluating new aircraft or replacement flight deck glazing.
- Obtain and maintain information on the UV transmission characteristics of flight deck windows. Where such information is unavailable, operators should request it from the aircraft manufacturer or certification authority or consider appropriate measurements to support occupational risk assessment.

7.3 Aircraft Manufacturers

Manufacturers should provide transparent and readily accessible information on the UV transmission characteristics of flight deck windows and continue to improve glazing technologies that minimise UV transmission while maintaining the required optical performance, structural integrity and certification standards.

Flight deck shading systems should be designed to provide effective protection from direct sunlight without adversely affecting flight safety.

7.4 Regulators

Regulators should consider incorporating minimum UV protection performance requirements for flight deck glazing into aircraft certification standards.

In addition, regulators should:

- encourage manufacturers to publish standardised information on flight deck window UV transmission characteristics to facilitate operator risk assessments and occupational health programmes;
- support further research into occupational UV exposure in aviation;
- promote harmonised guidance on occupational UV risk management;
- encourage occupational health surveillance programmes for flight crew; and
- support the development of international guidance on flight deck UV protection in collaboration with industry stakeholders.

8. ESSENTIAL MESSAGES

Regulators should consider incorporating minimum UV protection performance requirements for flight deck glazing into aircraft certification standards.

In addition, regulators should:

- encourage manufacturers to publish standardised information on flight deck window UV transmission characteristics to facilitate operator risk assessments and occupational health programmes;
- support further research into occupational UV exposure in aviation;
- promote harmonised guidance on occupational UV risk management;

- encourage occupational health surveillance programmes for flight crew; and
- support the development of international guidance on flight deck UV protection in collaboration with industry stakeholders

REFERENCES

European Cockpit Association (ECA). *Protecting Pilots Against UV-A Radiation.* Position Paper. 2025.

Baczynska KA, Brown S, Chorley AC, et al. In-flight UV-A exposure of commercial airline pilots. *Aerosp Med Hum Perform.* 2020;91(6):501–510.

Cadhilac P, Bouton M-C, Cantegril M, et al. Inflight ultraviolet radiation on commercial airplanes. *Aerosp Med Hum Perform.* 2017;88(10):1–5.

Chorley AC, Baczynska KA, Benwell MJ, et al. Occupational ocular UV exposure in civilian aircrew. *Aerosp Med Hum Perform.* 2016;87(1):32–39.

Emslie NA, Liley JB, Johnston P. Pilot ultraviolet A exposures in the cockpit of flying commercial aircraft. *Aerosp Med Hum Perform.* 2025;96(9):803–809.

Fadadu RP, Wei ML. Ultraviolet A radiation exposure and melanoma: A review. *Melanoma Res.* 2022;32(5):405–410.

Gallagher RP, Lee TK, Bajdik CD, Borugian M. Ultraviolet radiation. *Chronic Dis Can.* 2010;29(Suppl 1):51–68.

Hammer GP, Blettner M, Zeeb H. Epidemiological studies of cancer in aircrew. *Radiat Prot Dosimetry.* 2014;161(1–4):244–247.

Moan J, Dahlback A, Setlow RB. Epidemiological support for an association between UV-A exposure and melanoma. *Pigment Cell Melanoma Res.* 2012;25(5):553–564.

Sanlorenzo M, Vujic I, Posch C, et al. The risk of melanoma in pilots and cabin crew: UV measurements in flying airplanes. *JAMA Dermatol.* 2015;151(4):450–452.
Scheibler C, Toprani SM, Mordukhovich I, et al. Cancer risks from cosmic radiation exposure in flight: A review. *Front Public Health.* 2022;10:947068.

Setlow RB, Grist E, Thompson K, Woodhead AD. Wavelengths effective in induction of malignant melanoma. *Proc Natl Acad Sci U S A.* 1993;90(14):6666–6670.

Yam JC, Kwok AK. Ultraviolet light and ocular diseases. *Int Ophthalmol.* 2014;34(2):383–400.

©2026 The International Federation of Air Line Pilots' Associations. This publication is provided for information purposes only, in all cases pilots should follow their company's guidance and procedures. In the interest of flight safety, reproduction of this publication in whole or in part is encouraged. It may not be offered for sale or used commercially. All reprints must credit IFALPA.