

Revision 1

Laser Strikes on Aircraft

13 October 2022

General

Civil Aviation Authority (CAA) advisory circulars (ACs) contain information about standards, practices, and procedures that the Director has found to be an **Acceptable Means of Compliance (AMC)** with the associated rule.

Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate AC.

Purpose

This AC describes an acceptable means of compliance with standards regarding the hazards of laser illumination of aircraft and the steps to be taken to minimise the risks to aviation safety.

Related Rules

This AC relates specifically to Civil Aviation Rule Part 91 Subpart A - *General*, and Part 91 Subpart C – *General Flight Rules*, and Part 12, Subpart B, *Notification, Investigation, and Reporting, of Occurrences*.

Change Notice

Revision 1 replaces the initial issue of this AC, dated 21 May 2009.

This Revision changes terminology to “laser strike”, from the previous “laser illumination incident” and adds a section on New Zealand regulations on lasers, which have been instituted since this AC was last published. It also removes references to the CAA800 form, as this is being phased out, in favour of the CAA005 form.

Lastly, it updates references and contact details, corrects typos and other minor errors and takes the opportunity to add a Version History.

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Version History

History Log

Revision No.	Effective Date	Summary of Changes
0	21 May 2009	Initial issue.
1	13 October 2022	<p>Updates technical information.</p> <p>Changes terminology from “laser illumination” to “laser strike”.</p> <p>Adds a section on New Zealand regulations on lasers, which have been instituted since this AC was first published in 2009.</p> <p>Removes references to the CAA800 form, as this is being phased out, in favour of the CAA005 form.</p> <p>Updates references and contact details.</p> <p>Corrects typos and other minor errors.</p> <p>Adds a Version History.</p>

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1. Introduction

- 1.1. The incidence of aircraft being illuminated, particularly at night, by laser-generated light has been trending upwards since portable laser pointers became freely available to purchase.
- 1.2. Even when directed at aircraft from several kilometres away, high-power laser pointers can dazzle pilots and cause temporary flash blindness, with significant safety risks to the aircraft. The most severe cases can also cause prolonged eye injury for the pilot.
- 1.3. Laser power output has also increased over recent years, and it is now possible to possess high-powered laser pointers that can be directed at aircraft and cause serious problems for pilots and the safe operation of an aircraft.
- 1.4. This AC provides information to operators and pilots regarding:
 - 1) actions that should be taken by crews if their aircraft is illuminated by a laser during flight or ground operations
 - 2) recommended mitigations while in flight, and
 - 3) pilot/operator obligations to report laser strike incidents to the local Air Traffic Control (ATC) unit and CAA.
- 1.5. A laser strike, i.e., an illumination of an aircraft by a laser, is an aircraft incident. As a consequence, operators are obligated to report any laser strike occurrences¹, as per rule 12.55, *Notification of incidents*.

2. Laser types that pose hazards

- 2.1. Lasers fall into five general categories: Class I, Class II, Class IIIa, Class IIIb and Class IV. The higher the Class number a laser has, the greater the hazard it presents. While all laser pointers pose a health risk to the human eye, Class I, II and IIIa laser pointers, that have typical output of less than 1 to 5 milliwatts (mW), are generally considered low risk. As outlined in Section 3, however, lasers with output greater than 1 mW cannot be imported into NZ without approval from the Ministry of Health.

Note: While ICAO² uses Roman numbers, US sites³ tend to refer to Class 2, Class 3 etc, with the result that a Class IIIa in ICAO is a Class 3R laser in some other sources. The New Zealand Ministry of Health uses both.

- 2.2. The red laser pointers commonly seen in classrooms and conference venues, low-powered devices of less than 1 mW, are normally a Class II laser device with insufficient power to cause actual physical harm, although they still require care

¹ Note that the term “occurrence” includes accidents and incidents, as per rule 12.3.

² <https://www.icao.int/MID/Documents/2017/RASG-MID6/RSA%2012-%20Revised-%20Laser%20Attacks%20Safety%20Guidelines.pdf>

³ <https://www.lasersafetyfacts.com/>

in their operation and use. Green laser pointers, however, are readily available with a maximum power rating of 5 mW, and are classified as a 'Class IIIa or 3R laser device'.

- 2.3. The colour of the laser is also a factor. The eye's maximum sensitivity to visible light is around the wavelength of a green laser, so the eye will interpret a green laser light of a given power as being up to 30 times brighter than a red laser of the same power. Direct eye exposure to a Class IIIa laser beam can result in temporary visual impairment.
- 2.4. Some effort would be required to inflict actual eye damage with a 5 mW green laser pointer as both the low power and the eye's natural defence (blinking reflex) would combine to limit potential damage.
- 2.5. However, some vendors are now advertising higher-powered (from 10 to 400 mW) green laser pointers – these are definitely harmful and can cause permanent eye damage. In recent years, even more powerful lasers have come on the market.
- 2.6. The severity and duration of the vision impairment varies significantly, depending on the intensity and wavelength of the light, the individual's current state of light (or dark) adaptation, and even the person's skin pigmentation (eye colour). The effects of exposure to a laser beam include:
 - **Distraction:** The dazzling effect on the eye can be a major distraction, particularly in situations of high workload (e.g. take-off, approach, and landing or if the aircraft is operating at low level, such as a Police or rescue helicopter).
 - **Temporary Visual Impairment:** Adverse visual effects that include:
 - glare (a temporary disruption in vision caused by bright light within an individual's field of vision)
 - flash-blindness (the inability to see, caused by bright light entering the eye) that persists after the illumination has ceased, and
 - after-image (an image that remains in the visual field after exposure to a bright light).
 - **Eye Injury:** Temporary or permanent damage to the eye caused by exposure to laser light. Normally the result of direct exposure to prolonged or high-power laser light.
- 2.7. Even without lasting damage to the eyes, laser strikes on aircraft can cause distraction, disorientation, and discomfort for pilots resulting in a potentially hazardous situation during critical phases of flight.

3. How lasers are regulated in New Zealand

- 3.1. The Ministry of Health has determined that laser pointers with a power output of more than 5 mW pose a greater risk of eye damage while those in excess of 500 Mw, typically Class IIIb and Class IV lasers, will burn skin and damage eyes.
- 3.2. Anyone who wishes to import, hold or supply lasers in New Zealand with a power output of more than 1 mW must obtain authorisation from the Director-General of Health.
- 3.3. Lasers with a power output of more than 1 mW are also on the New Zealand Customs Service list of Prohibited items so, if imported without authorisation, are likely to be seized by Customs.
- 3.4. The Ministry of Health webpages listed in Section 8, below, provide information on how to apply and how to work out if a device needs approval.

4. How pilots can mitigate effects of a laser strike

- 4.1. The time and place of a targeted (or inadvertent) laser strike on an aircraft is difficult to predict, although there is evidence that aircraft operating in certain locations, particularly around airports, are increasingly likely to be targeted.
- 4.2. Whenever practicable, pilots should consider avoiding any area where a laser strike has been reported by preceding aircraft. Pilots operating in controlled airspace should obtain an ATC clearance before deviating from their cleared flight path, having first dealt with their immediate safety concerns.
- 4.3. If a pilot encounters a laser strike they should:
 - i. Not stare directly into the laser beam – avert or shield the eyes if possible.
 - ii. If the vision of one pilot in a two-pilot crew is affected, hand over control (as long as the other pilot has not been affected).
 - iii. If manually flying aircraft fitted with modern autopilots and Flight Management Systems (FMS), consider autopilot re-engagement, and use of FMS to aid flight path control.
 - 4) Turn up cockpit lighting, as this may assist in overcoming the ‘flash’ after-effects (and peripheral vision may still be effective).
 - 5) Try not to rub their eyes after exposure.
 - 6) If any lingering effect is experienced, seek medical attention after landing.

Note: Actions in 4.3(ii) and (iii) should be carried out in a manner consistent with aircraft/ operator Standard Operating Procedures (SOPs).

5. Reporting a Laser Strike to an ATC unit

- 5.1. As soon as possible following a laser strike, the flight crew should report the incident by radio to the appropriate ATC unit. Timely reporting will allow ATC to

alert other pilots to the hazard more quickly and increase the chances of locating the source of the laser strike (s).

- 5.2. The initial radio report to ATC should include the:
 - i. Aircraft call sign
 - ii. Nature of report (laser strike)
 - iii. Aircraft position at time of occurrence
 - iv. Aircraft altitude at time of occurrence
 - v. Colour of laser
 - vi. Location of origin of light source or relative direction and estimated distance from aircraft⁴, and
 - vii. Any other information that might assist law enforcement.
- 5.3. All ATC units advised of a laser strike will provide relevant information to any following aircraft.
- 5.4. In accordance with the Manual of Air Traffic Services, the ATC unit involved will also contact the Police as soon as possible and provide them with a detailed report to help in locating the source of the laser.

6. Reporting a laser strike to CAA

- 6.1. A laser strike of an aircraft constitutes an aircraft incident so a pilot who experiences a laser strike is required to submit details of the incident to CAA the Authority either:
 - i. if a serious incident (e.g. causing flight crew incapacitation), in accordance with [rule 12.55, Notification of incident](#), or
 - ii. in accordance with [rule 12.57, Details of incident](#).
- 6.2. The information provided will help CAA and other agencies identify the key risk areas and determine appropriate mitigation and solutions in concert with other agencies.

7. Recommendations for Operators

- 7.1. All air operator certificate (AOC) holders should consider including specific materials to ensure that their exposition contains guidance for crews on the immediate actions to be taken to mitigate the effects if their aircraft is targeted by a laser strike. The guidance should also include follow-up action, including the

⁴ Pilots should avoid looking directly at the source (as the priority is to minimise exposure effects).

need to report the incident. Crew members should be encouraged to seek medical attention if the eye exposure to a laser is lasting or if there are any lingering effects.

8. Related Information

8.1. The links below contain information about controls on the importation, supply and acquisition of laser pointers in New Zealand, including a guide to how to tell if a device is a high-power laser pointer:

- <https://www.health.govt.nz/our-work/environmental-health/high-power-laser-pointers>
- <https://www.health.govt.nz/our-work/environmental-health/high-power-laser-pointers/questions-and-answers-new-controls-high-power-laser-pointers>
- <https://www.customs.govt.nz/business/import/import-prohibited-and-restricted-imports/prohibitions-and-restrictions/>

8.2. The relevant Health and Customs regulations are available at:

- [Health \(High-power Lasers pointers\) Regulations 2013](#) which restricts the supply of high-power laser pointers to those who are authorised suppliers and also restricts the acquisition of such devices to those who are authorised recipients.
- [Customs Import Prohibition \(High-power Laser Pointers\) Order 2019](#) which restricts the importation of high-power laser pointers to those people who have received consent from the Director-General of Health to import them.

8.3. Lasers are also covered in the [Summary Offences Act \(1981\), section 13B](#) which details fines, imprisonment or forfeiture rules for possession of high-power laser pointers, and the [Aviation Crimes Act 1972 section 5\(c\)](#) which authorises Police to prosecute individuals using lasers to target aircraft.

There is more general information in the Vector articles below:

- [A new hazard –bird-scaring lasers](#), Autumn 2021
- [Report Laser Strikes](#), March/April 2018

And on the CAA website:

- <https://www.aviation.govt.nz/about-us/media-releases/show/Police-and-commercial-pilots-appeal-to-put-an-end-to-laser-strikes>
- <https://www.aviation.govt.nz/about-us/media-releases/show/use-christmas-laser-lights-safely>
- <https://www.aviation.govt.nz/safety/aviation-concerns/>