CIVIL AVIATION AUTHORITY
OF NEW ZEALAND

# Advisory Circular
# AC91-17

**Revision 0**

## Laser Illumination Of Aircraft

**21 May 2009**

### General

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

An AMC is not intended to be the only means of compliance with a rule, and 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 Advisory Circular.

An Advisory Circular may also include **guidance material (GM)** to facilitate compliance with the rule requirements. Guidance material must not be regarded as an acceptable means of compliance.

### Purpose

This Advisory Circular provides information to the aviation community, particularly pilots, regarding the hazards of laser illumination of aircraft and the steps to be taken to minimise the risks to aviation safety.

### Related Rules

This Advisory Circular relates specifically to Civil Aviation Rule Part 91 Subpart A - *General* , and Part 91 Subpart C – *General Flight Rules*.

### Change Notice

Initial issue.

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# LASER ILLUMINATION OF AIRCRAFT

## 1 Introduction

1.1 The incidence of aircraft being illuminated, particularly at night, by laser-generated light appears to be on the increase. It has not been confined to the illumination of aircraft on normal flight paths, but also includes the deliberate illumination of aircraft involved in police duties. Laser technology has improved over the years, and it is now possible to purchase high-power lasers that can be used to cause serious problems for the safe operation of an aircraft through the distraction and possible incapacitation of the pilots.

1.2 This AC provides information to operators and pilots regarding actions that should be taken by crews if their aircraft is illuminated by a laser during operation. Guidance is also provided on recommended mitigation, reporting and follow-up actions.

## 2 Hazards

2.1 The red laser pointer commonly seen in classrooms and conference venues are low-powered devices of less than one milliwatt (mW). These are normally a 'Class 2' laser device (the higher the class number, the greater the hazard), with insufficient power to cause actual physical harm, although they still require care in their operation and use.

2.2 Green laser pointers are readily available with a maximum power rating of 5 mW, and are classified as a 'Class 3R laser device' (more hazardous that Class 2). The eye's maximum sensitivity to visible light is around the wavelength of a green laser, and 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 3R laser beam can result in temporary visual impairment.

2.3 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. 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.

2.4 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).
- 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.

2.5 Laser illumination of aircraft can cause distraction, disorientation, and discomfort for pilots resulting in a potentially hazardous situation during critical phases of flight.

## 3 Pilot Mitigation Strategies

3.1 The time and place of an unauthorised illumination of an aircraft by a laser is difficult to predict, although there is evidence that aircraft operating in certain locations, particularly around airports, are increasingly likely to be subject to unauthorised illumination. Whenever practicable, flights within areas of recently reported laser or bright light activity should be avoided. 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.

3.2 In the event that a pilot encounters an unauthorised laser illumination of an aircraft, the following actions are recommended:

- Do not stare directly into the laser beam – avert or shield the eyes if possible.
- If your vision is affected, hand over control[1] (assuming a two-pilot crew, and that the other pilot has not been affected).
- Crews manually flying aircraft fitted with modern autopilots and Flight Management Systems (FMS) might need to consider autopilot re-engagement, and use of FMS to aid flight path control[1].
- Turning up cockpit lighting may assist in overcoming the 'flash' after-effects (peripheral vision may still be effective).
- Do not rub the eyes after exposure.
- If any lingering effect is experienced, seek medical attention after landing.
- Report the occurrence immediately to ATC, and as soon as possible through your normal reporting channel.

[1]*Consistent with aircraft/operator Standard Operating Procedures*.

## 4 Reporting a Laser Illumination Incident

4.1 As soon as possible following laser illumination occurence, the flight crew should report the incident by radio to the appropriate ATC unit. Expeditious reporting will allow ATC to alert other pilots to the hazard and will assist the Police in locating the source of the laser transmission(s).

4.2 The initial radio report to ATC should include the following:

- Aircraft call sign
- Nature of report (laser illumination)
- Aircraft position at time of occurrence
- Aircraft altitude at time of occurrence
- Colour of laser
- Location of origin of light source or relative direction and estimated distance from aircraft[2]
- Any other information that might assist law enforcement

[2]*Pilots should avoid looking directly at the source (priority is to minimise exposure effects)*

## 5 Follow-up Actions

5.1 All ATC Units advised of a laser illumination occurrence will provide relevant information to any following aircraft. In accordance with the Manual of Air Traffic Services, the ATC Unit involved will also contact NZ Police as soon as possible and provide them with a detailed report to assist in locating the source of the laser.

5.2 An unauthorised illumination of an aircraft by a laser constitutes an aircraft incident and therefore a pilot experiencing a laser illumination occurrence is required to submit details of the incident to the Authority in accordance with CAR 12.57 or, if the laser illumination occurrence is a serious incident (e.g. causes flight crew incapacition), the incident must be notified to the Authority in accordance with CAR 12.55.

5.3 In addition to the requirements of Part 12 for notifying and reporting incidents, pilots experiencing a laser illumination of an aircraft are also requested to complete a "Laser Beam Exposure Questionnaire" (form CAA 800) and submit it to the CAA, either directly or through normal company channels (as appropriate). Form CAA 800 is available on the CAA website http://www.caa.govt.nz/Forms/CAA800.pdf . The information provided will assist the CAA in identifying the key risk areas and determining appropriate mitigation and solutions in concert with other agencies.

## 6 Recommendations for Operators

6.1 All AOC holders should ensure that their exposition contains guidance information for crews on the immediate actions to be taken to mitigate the effects if their aircraft is targeted by a laser illumination. The guidance should also include follow-up action including the need to report the incident. Crew members should be encouraged to seek medical attention if the eye exposure to a laser is of more than transient duration or if there are any lingering effects.

## 7 Related Information

7.1 There are a number of very informative documents and articles on the hazards of lasers for aviation. The following references provide some further suggested reading material:

- "Vector" magazine Jan/Feb 2008: Laser Incidents in New Zealand Aviation (www.caa.govt.nz/Publications/Vector/Vector_2008_Issue-1_Jan-Feb.pdf)
- FAA AC No:70-2: FAA reporting requirements for laser illumination incidents. (FAA website: www.faa.gov)
- DOT/FAA/AM-06/23: A US review of recent laser events in aviation from a medical perspective. A study by the US Office of Aerospace Medicine. (www.faa.gov/library/reports/medical/oamtechreports/2000s/media/200623.pdf)
- CRS Web RS22033: Lasers aimed at aircraft cockpits. A report for US Congress prepared by the Federation of American Scientists. (www.fas.org; www.fas.org/sgp/crs/RS22033.pdf)