



GHANA  
CIVIL AVIATION AUTHORITY

# ADVISORY CIRCULAR

## AC 14-041

### ENSURING LASER COMPLIANCE BY AERODROME OPERATORS

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## GENERAL

### 1.1 PURPOSE

Ghana Civil Aviation Authority (GCAA) Advisory Circulars from the Aerodrome Safety and Standards (ASAS) section contain information about standards, practices and procedures that the Authority has found to be Acceptable Means of Compliance (AMC) with associated Directives.

An AMC is not intended to be the only means of compliance with a Directive, and consideration will be given to other methods of compliance that may be presented to the Authority.

The purpose of this Advisory Circular (AC) is to provide guidance to Aerodrome Operators to identify whether non-aeronautical ground lights or a laser emitter near the aerodrome, which may endanger the safety of aircraft, are properly shielded. Consequently, the aim of this Guidance Material is to properly assess the impact of any such activity and take appropriate measures to extinguish, shield or otherwise modify the hazardous non-aeronautical lights or Laser emitter near aerodrome operators which may strike a pilot of an aircraft thereby endangering the safety of aircraft. This Guidance Material also provides general information and advice on measures to protect pilots of an aircraft from accidental laser beam strikes, on or in the vicinity of an aerodrome.

### 1.2 RELATED DIRECTIVES AND DOCUMENTATION

The guidance contained in this advisory circular is directly related to provisions in the following Directives and Documents —

- Ghana Civil Aviation Act 2004 (Act 678),
- Ghana Civil Aviation (Aerodromes) Directives (GCADs)
- ICAO Manual on Laser Emitters and Flight Safety (Doc 9815)

### **1.3 STATUS OF THIS ADVISORY CIRCULAR**

This is the first issue of this AC.

### **1.4 FOREWORD**

Ghana as a Contracting State to the Convention on International Civil Aviation has an obligation to the international community to ensure that civil aviation activities under its jurisdiction are carried out in strict compliance with the Standards and Recommended Practices contained in the nineteen (19) Annexes to the Convention on International Civil Aviation, in order to maintain the required aviation standards.

Per the civil aviation requirements for an Aerodrome, specified in GCADs Volume 1 (*Aerodrome Design and Operations*), and related documents, an aerodrome operator is required to ensure that a non-aeronautical ground light or laser emitter near an aerodrome which might endanger the safety of aircraft, is extinguished, screened or otherwise modified so as to eliminate the source of danger.

This Advisory Circular provides guidance to aerodrome operators and other stakeholders to take corrective action with any internal or external agencies to shield non-aeronautical ground lights or Laser emitters near the aerodrome which may endanger the safety of aircraft.

### **1.6 APPLICATION**

The provisions under this guidance shall apply to Aerodrome Operators and other proponents. Aerodrome Operators shall follow the mechanism stated herein and take appropriate measures to implement the relevant GCADs to ensure air safety.

**APPROVAL**

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	 Director – General	



- Advisory Circulars are intended to provide advice and guidance to illustrate a means, but not necessarily the only means, of complying with the Ghana Civil Aviation Directives, or to explain certain regulatory requirements by providing informative, interpretative and explanatory material.
- Where a Directive contains the words “prescribed by the Authority,” the AC may consider to “prescribe” a viable method of compliance, but status of that “prescription” is always “guidance” (never a directive).



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## GLOSSARY

### DEFINITIONS

When the following terms are used in this manual, they have the following meaning:

The power per unit area expressed in watts per square centimetre (W/cm<sup>2</sup>). Small values may be expressed as micro watts per square centimetre ( $\mu$ W/cm<sup>2</sup>) or Nano watts per square centimetre (nW/cm<sup>2</sup>).

**Irradiance (E)** means the power per unit area expressed in watts per square centimetre (W/cm<sup>2</sup>). Small value may be expressed as micro watts per square centimetre ( $\mu$ W/cm<sup>2</sup>) or Nano watts per square centimetre (nW/cm<sup>2</sup>).

**Laser** means

- i. An acronym for light amplification by stimulated emission of radiation.
- ii. A device that produce an intense, coherent, directional beam of optical radiation by stimulating emission of photons by electronic or molecular transition to lower energy level.

**Maximum Permissible Exposure (MPE)** means the internationally accepted maximum level of laser radiation to which human beings may be exposed without risk of biological damage to the eye or skin.

**Protected Flight Zones** means airspace specifically designated to mitigate the hazardous effects of laser radiation.

**Laser-beam critical flight zone (LCFZ)** means airspace in the proximity of an aerodrome but beyond the laser-beam free flight zone (LFFZ) where the irradiance is restricted to a level unlikely to cause glare effects.

**Laser-beam free flight zone (LFFZ)** means airspace in the immediate proximity to the aerodrome where the irradiance is restricted to a level unlikely to cause any visual disruption.

**Laser-beam sensitive flight zone (LSFZ)** means airspace outside, and not necessarily contiguous with, the LFFZ and LCFZ where the irradiance is restricted to a level unlikely to cause flash-blindness or after-image effects.

**Normal flight zone (NFZ)** means airspace not defined as LFFZ, LCFZ or LSFZ but which must be protected from laser radiation capable of causing biological damage to the eye.

## CHAPTER 1 INTRODUCTION

Lasers can produce a beam of light of such intensity that permanent damage to human tissue, in particular the retina of the eye, can be caused instantaneously, even at distances of over 10 km. At lower intensities, laser beams can seriously affect visual performance without causing physical damage to the eyes.

Protection of pilots against accidental laser beam strikes has become a serious factor in aviation safety with the advent and proliferation of laser beam displays for entertainment or commercial purposes.

To protect the safety of aircraft against the hazardous effects of laser emitters, the following protected zones should be established around aerodromes:

- (a) a Laser-beam Free Flight Zone (LFFZ);
- (b) a Laser-beam Critical Flight Zone (LCFZ); and
- (c) a Laser-beam Sensitive Flight zone (LSFZ).

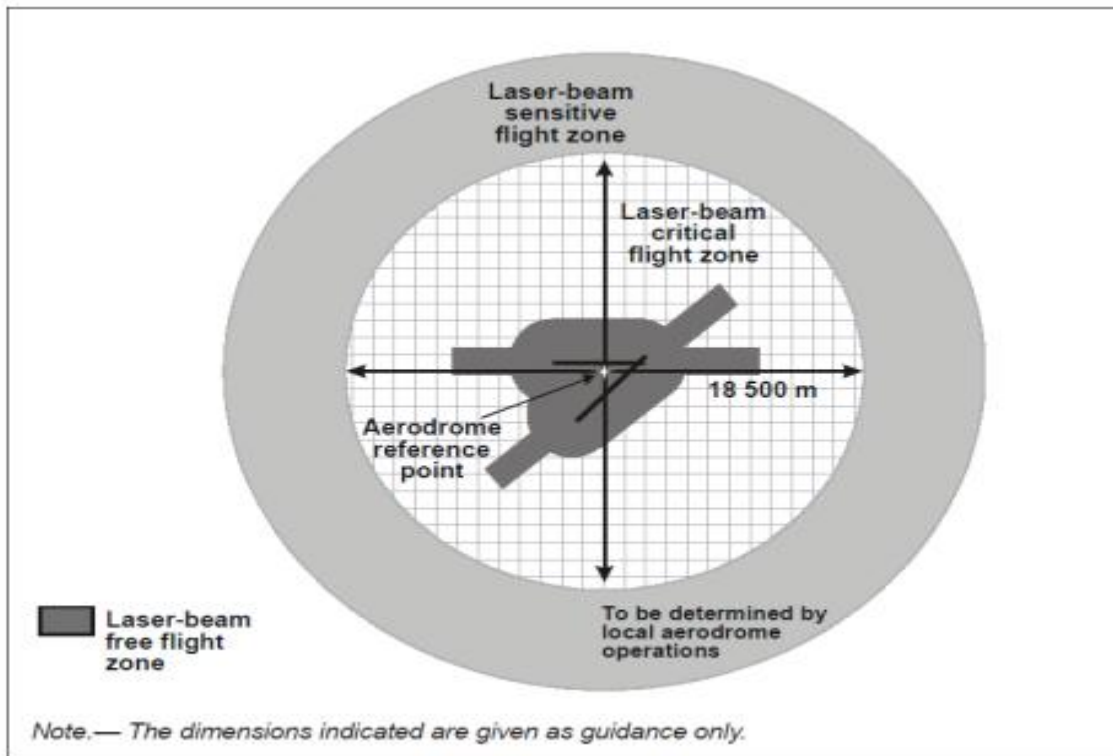
These protected flight zones are established in order to mitigate the risk of operating laser emitters in the vicinity of aerodromes. The dimensions indicated for the various zones are given as guidance and ICAO Doc 9815 advises that they have been found to provide for the safe operation of aircraft in the vicinity of aerodromes.

Restrictions on the use of laser beams in the three protected flight zones, LFFZ, LCFZ, and LSFZ, refer to visible laser beams only.

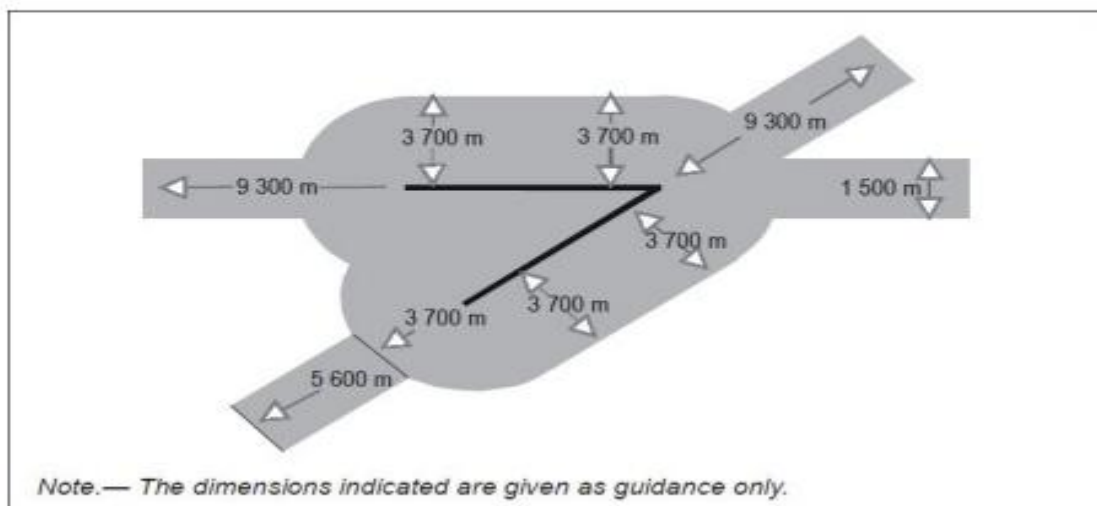
Furthermore, laser emitters operated by authorities in a manner compatible with flight safety are excluded from these restrictions. Typical examples of lasers used to support aviation, include some cloud base or visibility measurement equipment, some bird harassing devices, and some aircraft docking guidance systems. Aerodrome authorities are to ensure that these lasers have the beam aimed in such a direction, and or that the timing of operation are controlled, to ensure no hazard is posed to aircraft operations.

In all navigable air space, the irradiance level of any laser beam, visible or invisible, is expected to be less than or equal to the Maximum Permissible Exposure (MPE) unless such emission has been notified to the authority and permission obtained.

Figures 1, 2, and 3 may be used to determine the exposure levels and distances that adequately protect flight operations.

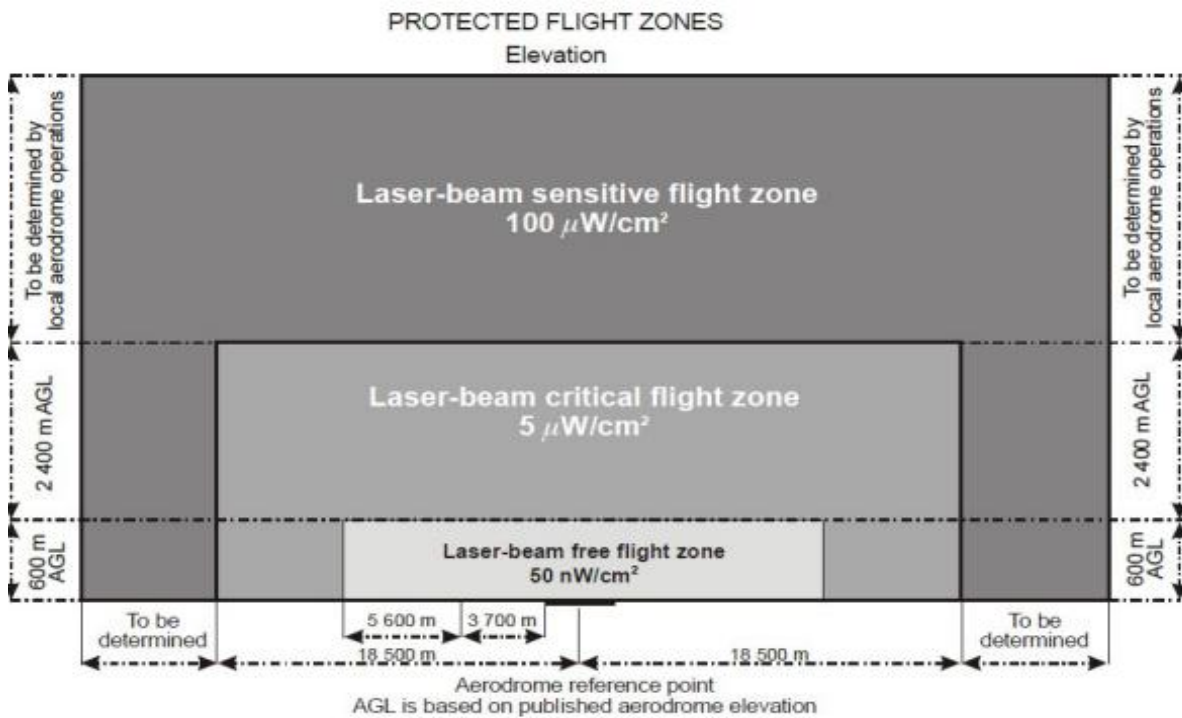


**Figure 1. Protected flight zones**



**Figure 2. Multiple runway laser-beam free flight zone**





**Figure 3. Protected flight zones with indication of maximum irradiance levels for visible laser beams**

## **CHAPTER 2      LASER-BEAM FLIGHT ZONES**

### **2.1      LASER-BEAM FREE FLIGHT ZONE**

Within this zone, the intensity of laser beam should be restricted to a level that is unlikely to cause any visual disruption. The irradiance should not exceed 50 nW/cm<sup>2</sup> unless some form of mitigation is applied. The level of brightness thus produced is indistinguishable from background ambient light.

### **2.2      LASER-BEAM CRITICAL FLIGHT ZONE**

- a) While the suggested extent of this zone is shown in the Figures 1, 2 and 3, this zone may have to be adjusted to meet air traffic requirements.
- b) Within this zone the irradiance should not exceed 5 μW/cm<sup>2</sup> unless some form of mitigation is applied. Although capable of causing glare effects, this irradiance will not produce a level of brightness sufficient to cause flash-blindness or after-image effects.

### **2.3      LASER-BEAM SENSITIVE FLIGHT ZONE**

- a) The extent of this zone should be determined by the operations at the particular aerodrome. The LSFZ need not necessarily be contiguous with the other flight zones.
- b) Within this zone the irradiance should not exceed 100 μW/cm<sup>2</sup> unless some form of mitigation is applied. The level of brightness thus produced may begin to produce flash-blindness or after-image effects of short duration; however, this limit will provide protection from serious effects.

### **2.4      NORMAL FLIGHT ZONE**

- a) The NFZ is any navigable airspace not defined as LFFZ, LCFZ or LSFZ. The NFZ should be protected from laser radiation capable of causing biological damage to the eye.
- b) The maximum irradiance level (MIL) should be equal to or less than the maximum permissible exposure (MPE).

## **CHAPTER 3      LASERS**

- a) Lasers used in the vicinity of aerodromes add to the known aviation-related problems associated with high intensity lights and can have a physiological impact upon pilots which could threaten aircraft safety, particularly at critical stages of flight such as final approach. Such physiological effects can include: glare, temporary flash blindness, after-image, and, possibly, eye injury. In addition, there is the potential for laser activity to dazzle and distract pilots of aircraft, and any planned laser activity must be organized to avoid this eventuality.
  
- b) Protection of the pilot against deliberate or accidental laser beam strikes has increased the risk of accidental illumination of aircraft from such displays, and therefore it is increasingly important to manage and mitigate those risks.

## **CHAPTER 4      CORRECTIVE ACTION**

### **4.1      ACTION BY AERODROME OPERATOR**

- i. The aerodrome operator shall include '*Non-aeronautical ground lights or Laser Emitter near the aerodrome*' in the 'Daily Checklist of Airport Lighting Condition Inspection Report'.
- ii. During daily inspection of the aeronautical ground lights, the Aerodrome Operator shall also observe whether there is any non-aeronautical ground light or a LASER emitter near the aerodrome, which may endanger the safety of aircraft, and make an entry in the Reports.
- iii. Whenever any Pilot reports to Air Traffic Controller about such hazardous light(s), Air Traffic Controller shall raise a report to concerned GCAA Safety Regulation Department/Division/Section.
- iv. On getting such report(s), the Aerodrome Operator shall take actions to extinguish, shield or otherwise modify the hazardous lights.
- v. If required, Aerodrome Operator may request the assistance of any State Agencies/ Municipalities.
- vi. If the Aerodrome operator is unable to solve the problem, a report of such hazardous lights shall be forwarded to Director-General, GCAA within 48 hours of raising the report.
- vii. If asked by GCAA to raise formal complaint against the owner or operator of the hazardous non-aeronautical light or Laser emitter in the local administration, the Aerodrome Operator shall take immediately comply, and shall follow up, as required.
- viii. Aerodrome Operator shall keep Aerodrome Safety Aerodrome Safety (ASAS) regularly informed.

### **4.2      ACTION BY GCAA HEAD OFFICE**

- A designated inspector or Officer of the Authority shall liaise with the owner or operator of the hazardous non-aeronautical light and / or laser emitter and request that he extinguishes, shields or otherwise modifies the light or laser emitter, by explaining the probable fatal consequences of the hazardous lights. The designated officer will also explain that if the proposed corrective actions are not taken, GCAA will refer the matter to law enforcement agencies for prosecution in accordance with the Ghana Civil Aviation Act.
- If the owner or operator fails to take the appropriate action, the GCAA may cause a notice to be served upon the owner of the place where the light is exhibited or

upon the person having charge of the light directing the owner or person, within a reasonable time to be specified in the notice, to extinguish or to shield effectually the light in the manner specified in such notice.

- In case the above actions fail, GCAA shall ask the Aerodrome operator to raise formal complaint in the local administration against the owner / operator of the hazardous non-aeronautical light and / or LASER emitter.

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