United Arab Emirates

GCAA
دولة الإمارات العربية المتحدة
الهيئة العامة للطيران المدني
UAE General Civil Aviation Authority

CIVIL AVIATION ADVISORY PUBLICATION

CAAP 49

(Revised December 2013)

LASER ILLUMINATION OF AIRCRAFT AND ATC TOWERS

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2. INTRODUCTION

The GCAA has become aware that the illumination of aircraft by laser generated light appears to be on the increase. The illumination of ATC Towers has also been reported. Laser technology has developed over the years and it is now possible to purchase high power lasers that could cause serious problems to the safe operation of either an aircraft or the ATC Tower.

Laser illumination could come from either accidental illumination of the aircraft or tower by a commercial entertainment or advertising display, or intentional illumination of the aircraft or tower by an individual or individuals.

3. PURPOSE

The purpose of this CAAP is to provide information to airport operators, aircraft operators, pilots and ATC management and staff regarding actions that should be taken when the aircraft or tower is illuminated by a laser.
It also provides guidance on recommended mitigation, reporting and follow-up actions.

4. STATUS OF THIS CAAP

This is Revision No.03 of CAAP 49 and is dated January 2014. It will remain current until withdrawn or superseded.

5. APPLICABILITY

This guidance applies to all UAE based Air Traffic Service Providers (ATSPs) and airlines.

6. REASON FOR REVISION

In addition to the changes made in Revision No. 02 released in October 2012, the CAAP is further revised in Revision No. 03 to add reference to recent reports of blue laser lights directed at aircraft.

7. HAZARDS

7.1 The red laser pointer commonly seen in conference venues is generally a low powered device of less than 1 milliwatt (mW), normally classified as a “Class 2" laser device.

7.2 Green laser pointers are readily available with a maximum rating of 5 mW and are classified as Class 3R. (The higher the number, the more hazardous the device is.) The human 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 exposure to a Class 3R laser beam can result in temporary visual impairment.

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 defences (blinking) would combine to reduce the potential to cause damage. However, some manufacturers are producing high powered green lasers (from 10 to 400 mW) – these are definitely harmful and can cause permanent eye damage.

7.3 Blue laser pointers are classified as Class 4 with ranges reported as up to 150 miles for the more powerful 1000mW professional versions.
They can light matches, cut material and pop balloons in close proximity to the origin of the beam.

Blue laser light 445 nm or 470nm is absorbed more effectively by Retina tissue compared to 532 nm green or 650 nm Red laser light

7.4 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) adaption 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 such as a cockpit during take-off, approach and landing, or in an ATC Tower.
- 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 bright light.
- Eye Injury: Temporary or permanent damage to the eye caused by exposure to laser light. This is normally the result of direct exposure to prolonged or high power laser light.
- Blue laser beams, either direct or reflected, can cause significant damage to the retina resulting in colour perception issues, blindness and this damage may continue to worsen for a period after receiving the blue laser strike.

7.5 In addition to the potential personal injury, laser illumination of an aircraft or control tower can cause distraction, disorientation and discomfort to the person viewing the illumination, resulting in a potentially hazardous situation during a critical phase of flight, in the case of an aircraft.

8. IMPACT

8.1 Directed bright light sources, particularly laser beams, projected near airports or into any airspace can cause two flight safety concerns:

- The primary concern involves non injurious levels of bright light unexpectedly entering the cockpit, resulting in reactions from startling the pilots to causing temporary vision impairment. The illumination and glare from the light may be short lived but the resulting effects could last for many seconds or even minutes.
- A secondary concern involves levels of bright light that are so powerful that they cause temporary or even permanent eye injury as a result of their contact with the eye.

8.2 The effect of the bright light sources on ATS personnel is similar to the effect on pilots in that they could cause the following concerns:

- Distraction, glare, temporary flash blindness, afterimage and possibly eye injuries. Again, the illumination may be short lived, but the effect may linger.
- Airport Operations could be disrupted or suspended for a considerable time if the source of the illumination could not readily be identified and eliminated.

9. MITIGATION STRATEGIES

9.1 PILOT MITIGATION:

The time and place of unauthorised illumination of an aircraft is difficult to predict, although evidence exists that this is more prevalent around airports. Whenever possible, flight in areas of reported unauthorised illumination of aircraft or areas of 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.

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, if consistent with SOP's, assuming a two crew operation and that the other pilot has not been affected;
- If able and consistent with SOPs, consider engagement of autopilot or FMS to aid flight path control;
- Turning up cockpit lighting may assist in overcoming the "flash" after effects (peripheral vision may still be effective);
- Do not rub your 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.

9.2 ATC MITIGATION:

In the event that control tower personnel encounter an unauthorised laser illumination of a tower, the following actions are recommended:

- Look away from the laser if possible, do not try to identify the source by staring at the laser;
- Shield your eyes and consider also using Sun blinds to reduce the effect;
- Do not rub your eyes after exposure;
- Turning up tower internal/equipment lighting may assist in overcoming the "flash" after effects (peripheral vision may still be effective);
- Consider transferring control to a colleague not affected;
- Advise any aircraft of the hazard and that ATC is affected as the perpetrator may also attempt to illuminate an aircraft.
- Inform the Supervisor and include as many of the 9.1 pilot report elements as are relevant,
- The Supervisor shall :
  - Determine if traffic restrictions should be imposed,
  - Inform airport authorities;

- Inform Police.
- Ensure that a ROSI report is filed.

9.3 BLUE LASER MITIGATION:

Blue lasers are Class 4 lasers therefore much stronger than red or green lasers. Even reflected blue light beams, in close proximity can cause permanent damage. The method of damaging eye tissue differs from other lasers in that the process reverses, under which the cells become unbleached and responsive again to light before the retina has had time to heal and may safely experience natural light rays. This greatly increases the potential for oxidative permanent damage. By this mechanism, some biological tissues such as skin, the lens of the eye, and in particular the retina may show irreversible changes induced by prolonged exposure to moderate levels of UV radiation and short-wavelength light after a blue laser strike.

Blue light hazard can cause problems with color perception issues, (particularly diminishing a person's perception of the colour green) and ultimately can result in blindness. Even accidental exposure for a short period may result in instant retina damage. Prolonged exposure to Blue laser light can alter and have a diminishing effect on a persons perception of the colour green. Patient who were treated for being exposed too long to intense blue laser light in the Mill watt range were only able to perceive the green colour after a period of about 4-6 months

10. REPORTING A LASER ILLUMINATION INCIDENT

10.1 PILOT ACTIONS:

As soon as possible after an occurrence, a pilot should advise ATC. Expeditious reporting will allow ATC to alert other pilots to the hazard and will assist the local Authorities in locating the source of the laser illumination.

The initial report to ATC should include as much of the following as possible:

- Aircraft callsign;
- Position of the aircraft in relation to the airport at the time of the laser beam encounter
- Height of the aircraft
- Direction of the laser beam in relation to the nose of the aircraft
- Distance of laser beam source from the aircraft
- Colour of the laser light
- How long was the laser beam observed prior to the light making contact with the eye
- Whether the laser beam light was steady or flashing
- Whether the laser beam was stationary and the aircraft "flew" into it or whether the beam motion was "random" and the aircraft "targeted"
- How many other laser light sources were observed at the time of the encounter
- Which cockpit window did the laser beam enter and at which position on the window did the beam enter (top, middle or bottom)
- Which pilot or pilots were affected by the laser light contact
- Any other information that might assist law enforcement.

In addition to ATC ROSI, an operator must submit an OPS ROSI if there was an operational difficulty in controlling the aircraft compromising safety of the aircraft.

10.2 ATC ACTIONS:

The ANSP has an important role to play regarding the detection and apprehension of the culprits through the early notification of such incidents to the appropriate law enforcement authorities including the GCAA Aviation Security Department.

ATC personnel should advise any aircraft in the vicinity of the potential threat. The pilot may be able to assist in locating the source of the laser, but not at the risk of exposing the aircraft to the threat.

To facilitate the appropriate response to these incidents ATC management should liaise with both the airport management and the local police force to establish the most expeditious reaction to such events.

A ROSI shall be submitted, containing all information reported by the pilot and, in the event of an illumination of the control tower, as much of the same information as is relevant to an ATC report.

11. FOLLOW UP ACTIONS

11.1 ANSPs should remind ATS personnel of their responsibilities for the safety of all traffic under their control. Reports to the authorities should be made by Supervisory or Management personnel. Normal incident reporting procedures must also be followed.

Should an ATCO be concerned about the effect exposure to a laser he should contact his AME and /or Ophthalmologist if available, otherwise any medical practitioner and arrange for an eye examination to determine if any eye trauma took place. This is especially important in the event of an illumination by a blue laser, where after such a strike efforts should be made to cover the eyes from all light sources, until a medical practitioner can examine the retina.

12 LEGAL USE OF LASERS

12.1 Lasers used in the vicinity of aerodromes add to the other aviation related issues related to high intensity lights. Lasers used in outdoor displays produce beams of varying degrees of intensity, indeed are more likely to be of higher intensity than “domestic” laser beams. When such beams are directed into airspace likely to be occupied by an aircraft, or are directed towards an ATC tower, unplanned exposure may occur.

12.2 The GCAA has published Regulations, (CAR Part VIII, Subpart 3) regarding the use of airspace which includes in Section 2 requirements for the use of lasers, fireworks, searchlights and other activities taking place in navigable airspace. Each Emirate’s Civil Aviation Authority should ensure that their requirements with respect to safeguarding airport activities are compatible with this Regulation and, with respect to lasers, in line with the laser related flight zones, as defined in CAR PART IX, to ensure that approved displays do not create a hazard to aviation. It is essential that light displays are never directed at or towards aircraft or aerodromes. Authorities need to ensure that organisations arranging light displays are aware of the hazards involved and limitations required.

12.3 CAAP 65 has also been recently published and contains requirements for the approval of laser displays. This CAAP also details the Laser Zones established in the vicinity of aerodromes.

12.4 The GCAA is in the process of setting up meetings with other concerned Authorities such as the Police, Customs and Emirate Municipalities to establish means of restricting malicious use of lasers and mitigating laser targeting of aircraft. Information on this will be notified to aviation stakeholders when finalised.

13 ADDITIONAL INFORMATION

13.1 There are a number of internationally available documents to assist personnel to develop internal procedures to mitigate this hazard.
These include the following:

- Eurocontrol:
  - SRC Doc 7 “Outdoor Laser Operations in Navigable Airspace”
- FAA:
  - AC No: 70-2 “ FAA reporting requirements for laser illumination incidents”
- UK CAA:
  - CAP 736 “Guide for the Operation of Lasers, Searchlights and Fireworks in UK Airspace”
- The International Laser Display Association:
- IFALPA:
  - Medical Briefing Note February 2009 “The effects of Laser Illumination of Aircraft”
- SKYbrary:
  - Laser Interference in Aviation.