AERONAUTICAL INFORMATION CIRCULAR 14/09

PILOT PROCEDURES FOR EXPOSURE TO LASER AND OTHER DIRECTED BRIGHT LIGHT SOURCES

(Replaces AIC 24/08)

Purpose

This aeronautical information circular (AIC) contains information and guidelines for flight crews encountering "laser illuminations" or other directed bright light sources while in flight. It also contains a reporting form for pilots to report directed bright light illumination incidents.

Background

Directed bright light sources projected near airports or into any navigable airspace can create potential flight control disruptions and/or eye injury to pilots, crew members, and passengers. The number of laser illuminations of aircraft has significantly increased during the past few years. In particular, the reporting of laser incidents involving law enforcement helicopters has substantially increased.

Canada and the U.S. have both recorded numerous instances of laser exposures that have been disruptive to flight operations. The effects of these occurrences to flight crews have ranged from startle to glare and, in some instances, flash blindness and afterimage.

Definitions

Afterimage: The perception of light, dark, or coloured spots after exposure to bright light that may be distracting and disruptive. Afterimages may persist for several minutes.

Directed bright light source: Devices capable of emitting a beam of high-intensity light, such as a laser, searchlight, spotlight, or image projector.

Flash blindness: A temporary vision impairment that interferes with the ability to detect or resolve a visual target following exposure to a bright light.

Glare: A reduction or total loss of visibility, such as that produced by an intense light source in the central field of vision, e.g. oncoming headlights. These visual effects last only as long as the light is actually present and affecting the individual's field of vision. Visible laser light can produce glare and can interfere with vision even at low energies, including levels well below that which produce eye damage.

Laser: An acronym for "light amplification by stimulated emission of radiation." A device that produces an intense, directional, coherent beam of light.

Startle: Sudden shock from surprise or alarm, which can cause an adverse psychological or physiological effect.

Discussion

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

1. The primary concern is when non-injurious, bright levels of directed light unexpectedly enter the cockpit. Depending on the brightness level, the light could startle the flight crew member(s); could cause glare, making it difficult to see out the windscreen; or could even create temporary vision impairment (flash blindness and/or afterimage). The illumination and glare may be short—one or a few bright flashes—but the startle and afterimage effects could persist for many seconds or even minutes.
2. A secondary concern is if a laser beam is so powerful that it causes temporary or permanent eye injury to anyone (pilots, crew members, passengers) viewing it. Fortunately, this is only a remote possibility because the laser power required to cause eye injury to a pilot in flight greatly exceeds that of lasers in common use today.

Therefore, the most likely in-flight safety hazard is that of a bright non-injurious flash causing disruption in the cockpit workflow. Such effects pose significant flight safety hazards when the cockpit workload increases, below 10 000 ft above ground level (AGL); in critical phases of flight (approach and landing); dense traffic areas (terminal environment and en-route areas); and in proximity to airports. This safety hazard is applicable to both single- and dual-engine cockpit operations.

Even laser pointers can cause adverse effects that could cause pilots to be distracted from their immediate tasks. Exposures to pilots from persons using laser pointers have been reported in increasing numbers, particularly against law enforcement helicopters.

Procedures

The primary purpose of this section is to outline preventative measures and incident procedures pilots can follow to either prevent potential illuminations or minimize cockpit disruption if one occurs. For simplicity, the following procedures refer to laser illumination incidents; however, the same procedures should be applied regardless of the source, whether it is a laser or any other directed bright light, such as a searchlight.

Preventive procedures: During aircraft operations into navigable airspace where laser illuminations are anticipated, flight crews should:

1. Consult NOTAMs for temporary laser activity. The NOTAM should include the location and time of the laser operations.
2. Avoid known permanent laser displays (e.g. Disney World). In the U.S., these sites are published in the *Airport/Facility Directory*. Currently, there is only one permanent site within Canada, which is located at the Shaw Millennium Park in Calgary, Alta. (510258N 1140530W 5 NM SW AIRPORT). Although this is a permanent laser display, it is only being utilized for special events (e.g. Canada Day); a NOTAM is published on those specific days.
3. Turn on additional exterior lights to aid ground laser safety observers in locating aircraft so they are able to respond by turning off the laser beam.
4. Turn on thunderstorm lights to minimize cockpit illumination effects.
5. Engage the autopilot.
6. Have one flight crew member stay on the instruments to minimize the effects of a possible illumination while in the area of expected laser activity.
7. Consider using notch filter eye spectacles that protect against 514- and 532-nanometer laser wavelengths, if flying a helicopter engaged in surveillance or medical evacuation.

Laser incident procedures: If a laser beam illuminates a pilot in flight, the pilot should:

1. Immediately look away from the laser source or try to shield the eyes with a hand or a hand-held object to avoid, if possible, looking directly into the laser beam.
2. Immediately alert the other flight crew member(s) and advise them of the illumination and its effect on their vision.
3. If vision is impaired, immediately transfer control of the aircraft to the other flight crew member. If both flight crew members have been illuminated, engage the autopilot, if equipped.
4. Be very cautious of spatial disorientation effects (the “leans”). After regaining vision, check cockpit instruments for proper flight status.
5. Resist the urge to rub the eyes after a laser illumination, as this action may cause further eye irritation or damage.
6. Contact ATC and advise of a “laser illumination.” Use this terminology for all laser incident/accident reports. If the situation dictates, declare an emergency.
7. When time permits, provide ATC with an incident report, which would include the location, direction, beam colour, length of exposure (flash or intentional tracking), and effect on the crew.

NOTE: As a follow-up, to ensure Transport Canada has sufficient information to analyze and investigate occurrences, please complete and submit the attached report form.

Medical follow-up procedures: After an in-flight illumination:

A crew member that has been subjected to a significant illumination causing persistent symptoms, such as pain or visual abnormalities (e.g. flash blindness and/or afterimage), should seek immediate medical attention. In addition, they should contact a regional aviation medical officer (RAMO) or aviation medical officer at the earliest opportunity. The medical officer will provide assistance in locating the nearest ophthalmologist or medical facility with experience in evaluating laser injuries. If outside Canada, contact the Civil Aviation Medicine (CAM) Branch in Ottawa. An eye damaged by a laser beam starts to repair itself immediately. Therefore, it is strongly recommended that an ophthalmologist, familiar with laser injury examination requirements, evaluate the crew member within five hours of the exposure to determine the nature of the injury and if it needs further follow-up action.

NOTE: Because diagnosis can be difficult, especially for medical personnel who rarely, if ever, see laser eye injuries, it should not be automatically assumed that a particular symptom, abnormality or injury was caused by a given laser exposure.

For assistance, please contact one of the following:

1.1 Civil Aviation Medicine Branch Offices

HEADQUARTERS	ATLANTIC REGION
Civil Aviation Medicine Transport Canada 330 Sparks St. Place de Ville, Tower C, Room 617 Ottawa ON K1A 0N8 Tel.: 613-990-1311 (General) Fax: 613-990-6623	*New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador* Civil Aviation Medicine Transport Canada 330 Sparks St. Place de Ville, Tower "C", Room 617 Ottawa ON K1A 0N8 Tel.: 1-888-764-3333 Fax: 613-990-6623

QUEBEC REGION	ONTARIO REGION
Quebec Civil Aviation Medicine Transport Canada 700 Leigh Capreol, Room 2007A Dorval QC H4Y 1G7 Tel.: 1-888- 570-5712 Tel.: 514-633-3258 (General) Fax: 514-633-3247	*Ontario* Civil Aviation Medicine Transport Canada 4900 Yonge St., 4th Floor North York ON M2N 6A5 Tel.: 1-877-726-8694 Tel.: 416-952-0562 (General) Fax: 416-952-0569
PRAIRIE AND NORTHERN REGION	**PACIFIC REGION**
Alberta, Yukon, Manitoba, Saskatchewan, Northwest Territories and Nunavut Civil Aviation Medicine Transport Canada 1140-9700 Jasper Ave. Edmonton AB T5J 4C3 Tel.: 1-877-855-4643 Tel.: 780-495-3848 (General) Fax: 780-495-4905	*British Columbia* Civil Aviation Medicine Transport Canada 600-800 Burrard St., Room 620 Vancouver BC V6Z 2J8 Tel.: 1-877-822-2229 Tel.: 604-666-5601 (General) Fax: 604-666-0145

Merlin Preuss
Director General
Civil Aviation

Please take a few minutes to complete this report and submit it as soon as possible after the incident.

Person filing the report	
Name	**Telephone Number**
Mailing Address	**E-mail Address**

Crew members (attach extra paper if required)		
Name	**Age**	**Glasses / Contact Lenses**
		☐ Yes ☐ No
		☐ Yes ☐ No
		☐ Yes ☐ No

Date and time of the incident			
Date	**Time**	**Aircraft Type**	**Flight No. / Call Sign**

Location and weather conditions			
Closest Airport/City	**VOR Radial/DME**	**Aircraft Altitude**	**Pitch and Bank Angle**
Phase of flight	**Procedure Identifier**	**Weather Conditions**	**Relative Darkness**

Light source location and position	
Angle from aircraft	
How did it hit you? (Straight in the eyes or off axis?)	
How did it enter the cockpit? (12 o'clock/left side window?)	

Light description	
Colour, static/moving	
Relative intensity (flashbulb, headlight)	
Duration of exposure	
Beam angle from ground	
Steady or flickering	
Was light visible prior to the incident?	☐ Yes ☐ No

Effect on crew member(s)	
Any after-effects?	☐ Yes ☐ No
Post-flight medical attention sought? **When, where?**	
What cockpit tasks were you performing when the exposure began?	
Did the illumination startle you?	☐ Yes ☐ No
How long do you estimate your attention was partly or fully averted as a result of the illumination?	
After the initial illumination, were you able to concentrate fully on flying, or were you partially preoccupied by what happened?	
Did the illumination cause any interruption to your vision?	
Could you see well enough during the illumination to adequately focus on instruments and outside references?	
Did the vision interruption cease immediately when you looked away from the source?	
Did "spots" persist in your vision after you exited the light beam? For how long?	
After leaving the light beam, was your vision "bleached" to the point where you could not adequately focus on objects inside or outside the cockpit? For how long?	
Were you distracted to the point where cockpit tasks were delayed or overlooked? **Please elaborate.**	
Were you visually or psychologically incapacitated to the point where you wanted to, or did, relinquish control of the aircraft to the other flight crew member?	
How long did this exist before you felt comfortable resuming control of the aircraft?	
Did the illumination interrupt the normal orderly flow of cockpit duties? **Please elaborate.**	
Did you experience eye pain? **Describe (location, intensity and persistence).**	
Did you rub or touch your eyes at the time of the incident?	

Effect on crew member(s) (cont'd)	
Did you feel disoriented at any time? Vertigo?	
Did the aircraft enter an unusual attitude? If so, describe it.	
How long did any symptoms you experienced from the exposure persist?	
Did the light appear suddenly, and did it become brighter as you approached it?	
Was the light coming directly from the source, or did it appear to be reflected off other surfaces?	
Was there more than one source of light?	
Describe any evasive manoeuvring you attempted.	
Did the beam follow you as you moved away?	

ADDITIONAL COMMENTS

Please forward this incident report to:

Chief of Standards
Aerodromes and Air Navigation
Tower C, Place de Ville, 330 Sparks St.
Ottawa, ON K1A 0N8

E-mail: alain.piche@tc.gc.ca