ASOS RESEARCH BRIEF

Research Request:

Lasers that pose a threat to aircrews and possible mitigations.

Research Response:

The recent surge in small, but powerful laser lights has increased the potential risk for pilots. These green laser pointers and other devices are easily available, and can be damaging. The possibility exists for a terrorist to use a laser device to blind a crew on an approach, and possibly cause an accident. While there have been no known terrorist activities involving lasers, a report by the FAA (The Effects of Laser Illumination on Operational and Visual Performance of Pilots During Final Approach) stated, “a laser attack could be quickly deployed and withdrawn, leaving no obvious collateral damage or projectile residue, and would be difficult to detect and defend against. The possible visual impairment, startle, distraction, and the loss of spatial orientation created by such an attack could make landing an aircraft difficult at best.” Not only are terrorists a possible threat, even an unknowing civilian can inadvertently blind a pilot temporarily if they use a laser improperly.

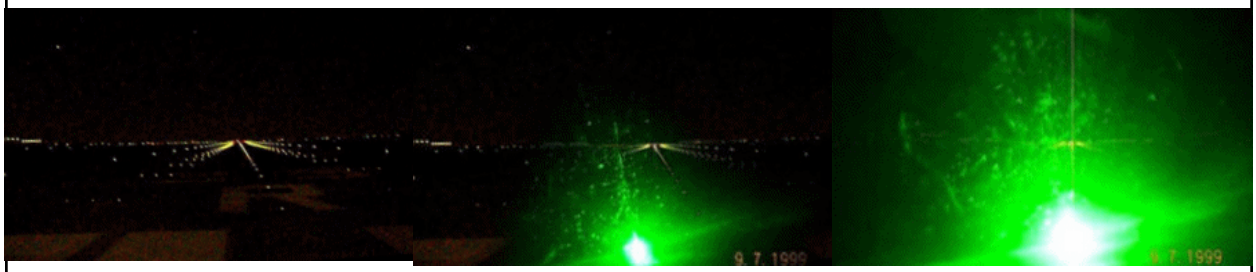
Study

In a study reported by the FAA (A Review of Recent Laser Illumination Events in the Aviation Environment, October 2006), data was recorded on incidents from December 2004 to January 2005. The report indicated there were 90 incidents, and approximately 14% of those actually resulted in visual impairment. Most of these incidents (62) involved the use of green lasers, and the remaining incidents used red lasers. None of the incidents were attributed to acts of terror. As more green lasers become available, incidents are likely to increase. To date, there have been approximately 900 laser related events since 2004.

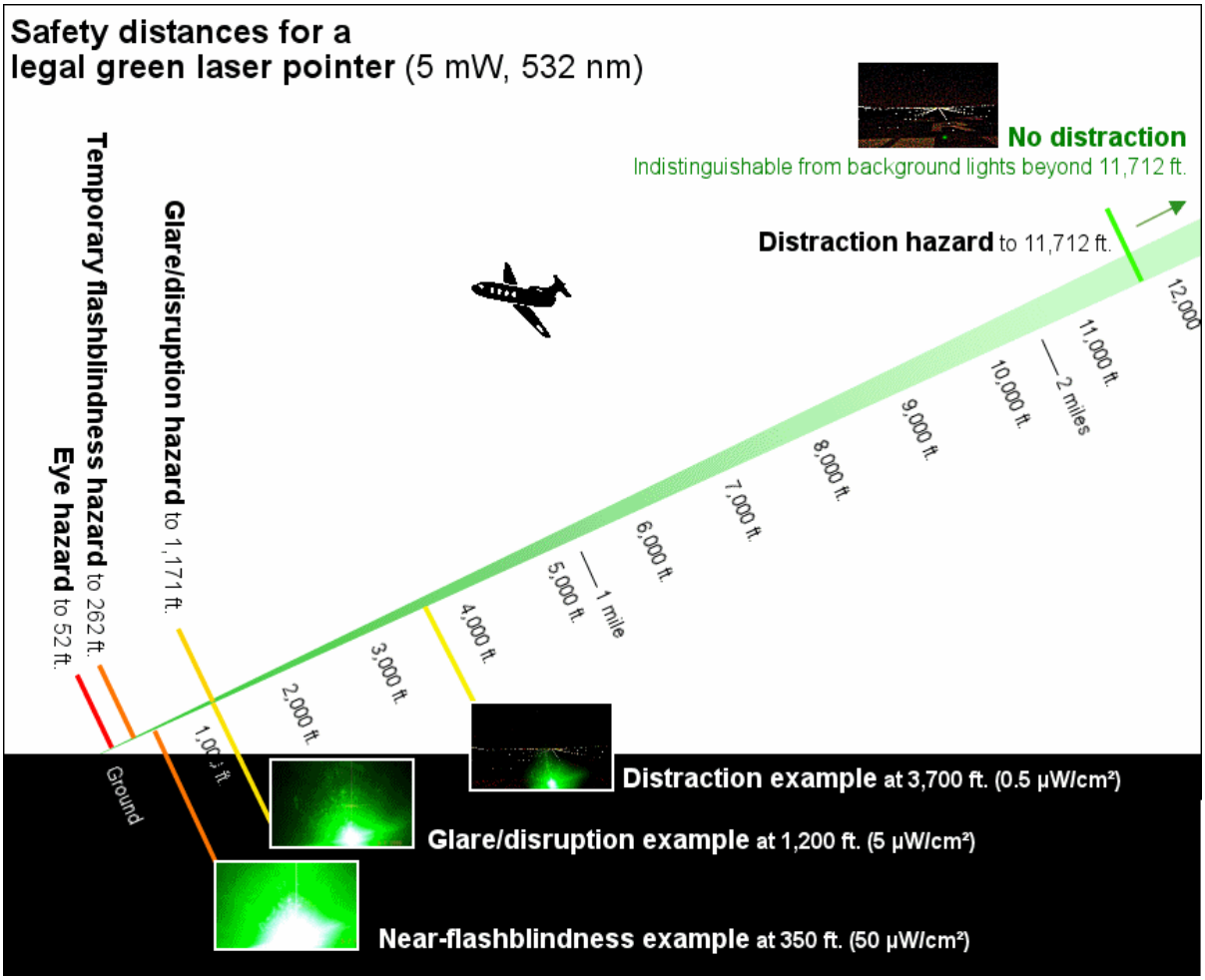
Impairment

The real hazard behind lasers is the vision impairment they cause. The lower the altitude, the greater the intensity and danger posed. A pilot, who has adjusted to night vision, is significantly more sensitive to a green laser light than during the day. Depending on the focus of the beam, it may cause severe glare or even temporary flash blind-

ness. If temporary flash blindness occurs, it may take a few seconds or a few minutes to return to normal vision. Laser light also has the potential to cause damage to the eye as well.

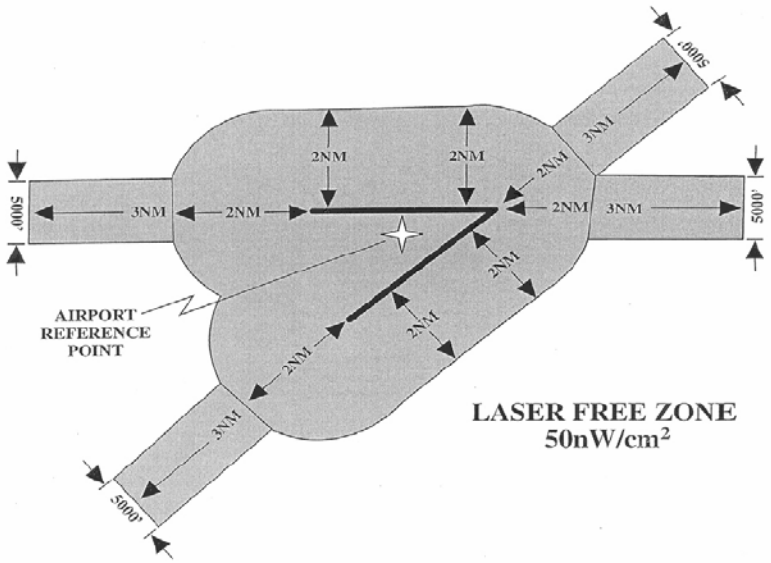


Green lasers depicted in various intensities



Current Prevention

Currently there are methods already implemented, and technology being developed to reduce or eliminate the laser hazard. The FAA has established Laser Free Zone's around airports that extend 2NM from the runway centerline, 3NM beyond the end of the runway, and 2000ft over the airport. Events such as laser light shows have strict guidelines under which they operate. Steps have also been taken to educate users of the harmful effects of lasers and the consequences of interfering with the safe operation of an aircraft. There have been a few arrests made as a result of deliberate use of a laser on an aircraft in the past and it is currently a federal offense.



Mitigation

There have been a few suggestions to mitigate the laser issue, and most of the research is being accomplished by the military. There are laser goggles; however, they cannot account for all the different types of laser colors. Additionally, goggles could interfere with instrument indications inside the cockpit. Technology integrated within the glareshield has been explored by organizations such as Penn State Engineering. Their technology involves the use of optical fibers made from liquid crystals that work dynamically as a laser light passes through. Glareshield technology is still not prevalent, due to the complexity of maintaining a normal view outside the cockpit. The Air Force has also researched the use of anti-laser contact lenses, though there appears to be no potential civilian application.

Thus far one of the more promising technologies has emerged, called the Laser Event Recorder (LER). LER has been utilized by the military and has moved over to some civilian applications. The device is designed to alert pilots of a potential laser threat, rather than prevent direct exposure. The LER works by detecting any potential laser immediately, and notifying the pilots through a series of lights. A yellow light indicates a laser light is in the vicinity but is not a direct threat. A red light indicates the laser light is

a direct threat to impairing vision. When a red light alert occurs, the device will take a digital snapshot of the source of the laser light, for review after the flight. For more information, please go to: http://www.optra.com

Research

The FAA and the Air Force have partnered to conduct research on the effects of lasers, and develop a solution to this problem. The project uses a B-737 simulator along with a non-harmful laser system that reproduces the effects of a laser from the ground being directed at the cockpit. Researchers will be able to monitor the effects of the laser at different angles and distances based on pilot reactions. The goal is not only prevention, but development of training techniques to avoid temporary blindness from lasers. For more information, please go to: http://www.photonics.com/content/news/2007/July/5/88320.aspx http://www.wpafb.af.mil/news/story.asp?id=123043199

Qioptiq, Ltd.

Qioptiq, a company based in the UK, offers laser protection in the form of goggles, visors, and sensors. Their technology includes the use of dielectric and holographic coatings, organic dyes, and absorbing glasses. For more information, please go to: http://www.qioptiq.co.uk/Products/Avionics/