RECOGNIZING LASER POINTERS & FLARES

By Jim O'Meara, Greatland Laser

While laser pointers can be a detriment to pilots, laser flares can be used by citizens in distress to signal for your help.

It was close to sunset when John and Cathy arrived at their campsite. They had just unpacked their gear when a loud rumble froze them in their tracks. The landslide reached Cathy first, pinning her to the ground. John was less fortunate, as the flow of debris carried him into a shallow ravine. Franticly, Cathy freed herself only to face the hopelessness of saving John. Across the valley, a helicopter was making its last trip from a logging camp. Cathy remembered the laser flare they purchased and knew how to use it.

Cathy aimed the laser at the helicopter, and the pilot immediately notified the FAA that he just had a laser strike his aircraft. He did not feel anything, nor was his vision affected, but he had heard about other pilots being "hit" by lasers and wondered what long term effects the unique flash would have on his vision.

The nightly news carried the story of yet another pilot blinded by a laser, as did the Associated Press. Pilots all over the world wondered what would have happened if it had been them. Cathy died from exposure on the mountain, and a hiker found her remains.

The above story is a hypothetical situation. But it demonstrates that the positive side of laser signaling technology is not getting enough exposure. Pilots should know that lasers can be used as distress signals, among other things. Lasers are easily seen in any environment, from dark storm-swept oceans to well-lit cities. Pilots notice them immediately, as supported by reports of laser sightings.

The law to make it a felony to shine any laser at aircraft unless it is an emergency would benefit those who use lasers for beneficial purposes. It is illegal to issue a false distress signal in any form, from stomping SOS in the snow to yelling mayday on a radio. So, it is appropriate to identify what lasers are distress signals and arrest anyone crying wolf.

Laser Flares vs. Typical Laser Pointers

At a common signaling distance of 1.5 miles, the laser power illuminating the cockpit and hitting the pilot's eye from a laser flare is about one trillionth of a watt. This power level is low, because the laser flare begins with a very small amount of laser light and then creates a very long two-dimensional fan (line) of light, further reducing the power density. This level can be easily detected but will not obscure pilot vision in any way.

However, because the light from a laser pointer remains in a relatively small one-dimensional pencil thin beam, the laser beam spot-size at the aircraft is about 240 cm (eight feet) in diameter. Because all of this light is concentrated in a relatively small spot, rather than spread out in a long line like the laser flare, the power density impinging on the pilot's eye is about 1,000 times greater from the laser pointer.

Therefore, although the signaling capability of the laser flare emergency rescue and signaling device remains effective for signaling SAR aircraft, the power level (brightness) of the laser flare is reduced by 1,000 times. This is a level where visual acuity is not affected.

It should be noted that even the laser pointer's output, although bright, is still about 10,000 times lower than the power level where eye injury can occur at a distance of 1.5 miles. The laser light power density from the laser pointer is 1,000 times higher than that from the laser flare, when both measured at 1.5 miles. Neither is a hazard for actual eye injury.

Assessing the Danger

In most cases, pilots need not worry about actual eye injury, but rather glare and afterimage from laser illuminations from laser pointers at close range on the ground. There are high-powered lasers being sold to the public, and should you encounter one of these during flight, do not look directly into the source of the illumination, as the center of your vision is the most sensitive and important portion of your field of view. If you are going to develop an afterimage from the glare, you do not want it in the center of your vision. By not looking at the source, the afterimage will appear elsewhere in your field of view. This can aid significantly in continued flight operations.

In no cases of aircraft illumination from laser pointers to date were the light levels high enough to cause actual eye injury. So don't panic. The illuminations can be very bright, like a camera's strobe flash, so be prepared, expect unwanted illuminations from all sources, and know how to handle cockpit illuminations before they occur.

The following images show how green lasers appear to a pilot at different power levels on approach to landing. Standard pointers would produce the first image, and a laser flare would appear to be roughly half of that. The last two images are from higher-powered lasers and are distracting.

Telling the Difference

The laser flare was designed 11 years ago from experience working with the FAA on airport lighting and the difficulty of searching for missing hunters and hikers. There are laser flares in use by civilian and military users worldwide. Their intention in an emergency is to shine the eye-safe laser flares at your aircraft, boats and other rescue assets for the purpose of saving their lives. Many agencies like the U.S. Border Patrol, U.S. Air Force, U.S. Navy, FAA and USFWS use the flares in training as coordinated visual signals for positional awareness during missions.

You can easily tell if a laser signal is from a laser flare or a pointer; the laser flare will be easy to look at with no aftereffects, and the pointer will be very bright and possibly distracting. You can also tell the difference by turning towards the source. If the signal stops, it is probably a prankster. If the signal persists, be aware that someone may be looking to you to spot their predicament from the air and aid in their survival.

SUPPORTING ANALYSIS

Rescue Laser Flare

7 mW
5-degree fan angle (87mrad)
1 mrad narrow axis divergence angle
1.5 miles = 2,414 meters
Area of laser line at 2,414 meters = 5.07 million CM^2
Watts/CM^2 = .007 / 5,070,000CM^2
= 1.38 x 10^-9 W/CM^2 = 0.000,000,001,4Watts/CM^2

Typical Laser Pointer

5 mW
1mrad divergence
1.5 miles = 2,414 meters
Area of spot at 2,414 meters = 45,745CM^2
Watts/CM^2 = .005/45,745CM^2 =
1.1x10^-7 W/CM^2 = 0.000,000,1Watts/CM^2