C45 Output Characterization of Handheld Lasers Used in Criminal Aircraft Illumination

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After attending this session, attendees will understand the basics of laser metrology, laser safety, and adverse visual interference effects that can be generated as they pertain to the evaluation of handheld lasers used in criminal aircraft illumination cases.

This presentation will impact the forensic science community by demonstrating a method for easy, rapid, and accurate characterization of handheld lasers used in criminal aircraft illumination cases, and to provide quantitative data to be used in the judicial process.

In providing quantitative data on the devices used, personnel involved in the prosecution of cases will be better able to educate those involved in the judicial process of the potential hazard that these devices present. Illumination from a hand-held laser can, at short range, induce permanent retinal damage. At long range, as in the cases of aircraft illumination from the ground, disruptive visual interference effects can occur. Effects such as flash blindness, after-image, and glare are possible from even relatively low-powered devices. Threshold irradiance values have been established by the Federal Aviation Administration (FAA) for varying degrees of visual interference effects.[1] This measurement system will allow for calculation of this irradiance from the devices in question.

The measurement system discussed will evaluate the devices in two ways. The first is to establish the actual optical power emitted from the device.[2] Recent studies have demonstrated that the majority of commercially available "laser pointers" are emitting laser radiation in excess of the federal limit, and in many cases, well in excess of the claimed output power shown on the labeling on the devices themselves.[3,4] This measurement system will enable easy and accurate evaluation of the output power. Since the degree of the hazard the devices pose is proportional to the optical power emitted, providing data on the actual power emitted (not simply what is claimed on the label) is essential.

The second aspect will provide a measurement of the divergence of the visible beam emitted from the laser. Since this system is to provide quantitative data for the prosecution of laser-aircraft illumination cases, it is important to provide accurate data for calculation of the irradiance at range. This divergence value, used in conjunction with the output power measured and the flight conditions recorded at the time of the incident provides the information needed to calculate the exposure conditions at the time of the incident.[5,6] The irradiance calculated in this process allows for a quantitative presentation of the potential short-range hazard and long-range visual interference effects these devices have when illuminating an aircraft.

This system is presented as a measurement solution that could be implemented easily within the law enforcement organizations tasked with prosecution of these cases. The design that will be discussed will emphasize ease of use, accurate results, and moderate cost to establish a measurement system. The end result will enable a better education on the potential hazards that hand-held lasers can create, and to promote that knowledge to those involved in the judicial process of criminal aircraft illumination cases.

References:

1. FAA AC No. 70-1
2. Meas. Sci. Technol. 24 045202 (2013)
3. 21 CFR 1040.10 & 1040.11
4. J. Laser Appl. 25, 032007 (2013)
5. FAA AC 70-2
6. ANSI Z136.6-2005 American National Standard for the Safe Use of Lasers Outdoors

Laser Pointer, Aircraft, Measurement

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