Implications of Zero Elevation Critical Airspace Zone Limits

CHANGES IN CRITICAL AIRSPACE DEFINITION

In the August 1995 meeting of the SAE G-10 Subcommittee, discussion of possible helicopter locations and elevations lead to the modification of the lower physical limit of the Critical Airspace Zone. Originally set at a 40:1 departure slope from the end of the runway, the lower limit for Critical Airspace rose to a minimum elevation of 350 after 10,000 feet distance, and to 1500 feet after 14,000 feet distance.

With the premise that helicopters could be at any location and elevation, it was recommended that the lower physical limit of Critical Airspace be set at ground level, providing additional protection for very low elevation aircraft. This change was adopted without substantial discussion.

Critical Airspace has an exposure limit of 5 microwatts per centimeter squared. This very low irradiance level is well below the emission of any practical laser. For example, a 5 milliwatt laser pointer with an emergent beam diameter of 1 mm has an irradiance of 0.64 watts per square centimeter, more than 100,000 times higher than the Critical Airspace limit. With a divergence of 1 milliradian, the 5 milliwatt beam has to travel more than 1000 feet before the beam irradiance is reduced to the 5 uW/cm^2 limit.

The ramifications of this restriction are significant. Within the Critical Airspace Zone (within 5 miles of an airport runway), any outdoor laser operation will require special control measures to comply with the new standard. Some mechanism will be required to ensure that the beam does not illuminate an aircraft. This mechanism may be **mechanical**, as in the form of beam stops, **automatic**, as in the form of scanfail or aircraft detection devices, or **human**, as in the form of aircraft spotters.

LASER POINTERS - AVIATION THREAT?

In the Federal Laser Product Performance Standard, demonstration lasers of less than 5 mW emitted power are permitted without the special controls that are required of demonstration lasers in excess of this power. Specifically, the LPPS is written so as to require a variance of the Standard for any demonstration laser above 5 mW. This variance requirement is the primary mechanism for keeping track of laser displays.

One of the most common consumer laser products, other than Telecommunications and CD players, is the laser pointer. With the advent of low cost visible diode lasers, the laser pointer has become ubiquitous. Anyone can buy a laser pointer without restriction, and due to the low cost, large quantities of pointers have been purchased.

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Part of the reasoning behind the 5 mW limit for demonstration laser products was the premise that without intentional exposure (staring into the beam), the potential for injury was remote. An accidental exposure would result in the aversion response, protecting the eye from injury. Even in abusive situations (laser pointer "wars"), injuries are not occurring. In essence the premise of non-intentional exposure has been shown as significant safety factor.

LASER POINTERS AND CRITICAL AIRSPACE

The new definition for the lower physical limit of Critical Airspace should be considered with respect to the laser pointer. Technically, outdoor operation of a laser pointer should be restricted with additional control measures. However, no regulations exist over the use of these devices, nor are there any records of who has purchased them. Therefore, there are no means of enforcing a restriction on the use of laser pointers, or even notifying the owners not to point them at aircraft.

Given that control over the use of these lasers is impractical, perhaps we should reexamine the premise that an exposure in excess of 5 uW/cm^2 at any elevation above the ground is unacceptable. Do we really believe that a laser pointer is a significant threat to air safety?

There have been incidents of people targeting aircraft with laser sights for firearms. With the assumption that a laser sight would likely be attached to a firearm, the reaction and concerns of the pilots is obvious. Exposure to the laser light may well have been the least of their worries,

Essentially, there are two solutions to this dilemma:

1) Redefine elevations below the original lower limit of Critical Airspace as a higher hazard zone (elevations below 1000 feet would not meet the 5 uW/cm^2 limit); Inform pilots of nature of the risk, and to "Recognize and Recover";

OR

2) Recognize that 5 uW/cm^2 is not a significant risk to air traffic, and that a much higher level is needed to seriously interfere with a pilot.

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FURTHER ANALYSIS

Given a minimum elevation of a police helicopter could be as low as 100 feet, the irradiance of our 5 mW laser pointer is more than 700 uW/cm^2, which is 140 times greater than the present limit. This is doubtless a very bright flash.

When any aircraft is operated below a 1000 foot elevation, it is subjected to higher risks. The most severe risk is collision with a physical obstruction, usually leading to a tragic accident. For narrow profile obstructions, such an antenna towers, it is considered an adequate control to prevent collision by visible signaling of the location and extent of the tower. This is accomplished with warning lights, such as strobes and beacons.

Obviously, the beam from a laser pointer is not in the same risk category as a tower without warning beacons. The aircraft is completely unaffected by it. The worst case: the pilot suffers a temporary vision effect, which occupies a very small area of his vision. In most any imaginable case, this would be an equivalent loss of control as a sneeze.

PRACTICAL SOLUTION

As a practical solution, I would recommend that elevations in the Critical Airspace Zone below 1000 feet AGL be considered Sensitive Airspace, with a 100 uW/cm^2 exposure limit. This would provide additional protection for helicopters without creating an unenforceable restriction on all lasers. Using our 5 mW laser pointer example, the 100 uW/cm^2 exposure level is reached at a distance of 260 feet.

A second safety element could use the tower warning beacons as an example, and provide a visible light warning to approaching aircraft at less than 1000 feet elevation that a laser is in operation, and that bright flashes could occur. This essentially serves as a long distance emission indicator.

Finally, better communication between the aircraft operators and the tower, to shut off laser displays when emergencies arose, would further reduce the potential for low elevation illuminations. This would particularly help the emergency service aircraft, both police and medical.

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