

Shed Light on Need for Workers' Eye Protection.

Researchers, funded by AFOSR, have developed new standards to protect workers from the potentially blinding effects of laser light.

The standards are being used by the Department of Defense and have recently been adopted as the national standard through the American National Standards Institute. They have also been proposed as the international standard.

"These new standards will impact the safe use of military, industrial and research lasers worldwide," said Maj. Pat Roach, Ph.D., of the Health Sciences and former AFOSR program manager. He, along with Dr. Benjamin Rockwell of Air Force Research Laboratory and his team from Litton-TASC, conducted research on laser light to fill a gap in safety standards.

These researchers headed up a cross-disciplinary team of investigators consisting of physicists and biologists from universities such as Massachusetts Institute of Technology, Harvard and Duke, as well as from the Air Force Research Laboratory. Prior to this research, there were no safety standards for ultrashort flashes of laser light, despite increasing use of laser technology in both the civilian and military sectors.

"The Department of Defense's use of ultrashort flashes of laser light continues to increase, driven by high operation tempos and new

technological demands," said Roach. "The military uses the technology to illuminate and designate targets, then send the laser-guided munitions to the target. Eventually, they will be used in the U.S.'s theater missile defense system."

Additionally, the use of lasers in the treatment of diseases and injuries has grown significantly over the last few years.

Notwithstanding the tremendous potential of lasers, there are still hazards associated with the technology. Ultrashort flashes of laser light to the human eye may result in permanent blindness. These flashes are less than one nanosecond long, or one billionth of a second. Despite the short duration, they carry a powerful punch. A single nanosecond exposure to the human eye will produce 100 tera-watts (one tera-watt equals 1,000 billion watts) of power at the focusing point within the eye. These ultrashort pulses can produce miniscule "fireballs" which can be as hot as the surface of the sun.

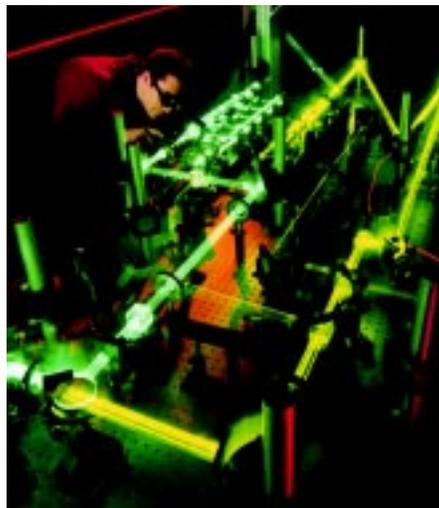
A "direct hit" is not the only danger to the human

eye. Indirect or a reflection off another surface can also harm people.

"Certain lasers are powerful enough to cause blindness when reflected off a carpet or other reflectors like a mirrored surface," said

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— Maj. Pat Roach, Ph.D.



Roach. "Some lasers are so bright that they can cause harm even at far distances."

The new standards detail safety limits when working with ultrashort laser pulses, including the maximum amount of exposure without risking injury. The guidelines also highlight ways to protect the retina and cornea, and include safety precautions for the skin as well. Workers can safely operate research industrial grade lasers, Roach believes, if the right controls safeguards and protections

are in place.

AFOSR's role in developing this standard and continuing research on the topic can't be overstated.

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Research continues on the effects of laser light on the human body. Some of the research initiatives include:

- Research on skin and corneal exposures to lasers used in the Department of Defense, including the Army's hand-held range finder and the Air Force's Airborne Laser weapon system.
- Researchers at the U.S. Air Force Academy, supported by AFOSR, are investigating the molecular effects of laser light on the eye. These studies can be important to the development of pharmaceutical remedies, the future establishment of a sensitive in vitro laser-hazard assessment system, and the identification of sub-threshold tissue alterations that may lead to more serious long-term effects.

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