Long Range Laser Induced Plasma
Navy SBIR 2011.3 - Topic N113-171
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**Opens: August 29, 2011** - **Closes: September 28, 2011**

N113-171 TITLE: Long Range Laser Induced Plasma

TECHNOLOGY AREAS: Sensors, Weapons

ACQUISITION PROGRAM: Joint Non-Lethal Weapons Program; (ACAT IV)

OBJECTIVE: Non-lethal weaponization of ultra-short pulse (pico-femtosecond) laser systems to produce laser induced plasma detonation (LIPD) in air or on material targets in close proximity to targeted humans. Current LIPD systems are capable of producing some optical out-put and a buzzing sound. We are interested in out-puts, comparable to existing flashbang systems. This capability is intended to produce non-lethal effects on human targets. Systems intended for use against material targets cannot be used in non-lethal scenarios and vice versa.

DESCRIPTION: The creation of plasma with a laser beam is utilized in technologies such as laser induced plasma spectroscopy and surface physics ultra-short pulse (pico-femtosecond) lasers. Similar technology could be potentially utilized in the non-lethal weapons sector to create a visual and auditory deterrent at a given range by ionizing air or ablating a solid target. Options are sought to design an above the state of the art non-lethal weapons system capable of creating laser plasma bursts while keeping the optical system resilient and portable by military means (personnel or small vehicle). Recent laser material development can be utilized in the design of the non-lethal system which should radiate at wavelengths greater than 1.4 microns to ensure retinal safety from inadvertent ocular exposure, with as small of a form factor as possible to create apparently continuous plasma. Goals for visual cues or temporary visual impairment include bright flashes and a bright light spray as a result of plasma bursts. Auditory cues should be the result of an extremely irritating buzz to be achieved through highly repeated plasma production at multiple plasma bursts per second and may be modulated to convey coherent, audible messages.

PHASE I: Analytically demonstrate that a laser system is capable of using retina-safe lasers to produce plasma with non-lethal effects at a range of hundreds of meters.

PHASE II: Develop and demonstrate a brassboard system capable of plasma production beyond 100 m.

PHASE III: Develop a system prototype that is portable by military means (personnel or small vehicle).

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: This technology could be used by any branch of the military or by civilian forces as a visual and/or auditory cue as a deterrent at an extended range to deny, move, or suppress personnel with the possibility of physical cues in the form of shockwaves or heat.

REFERENCES:
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3. Vaill, J.R., Tidman, D.E., Wilkerson, T.D., Koopman, D.W. (1970). Propagation of high-voltage streamers along laser-induced ionization trails. Applied Physics Letters, 17 (1), 20-22.

4. Vogel, A. & Venugopalan, V. (2003). Mechanism of pulsed laser ablation of biological tissue. Chemical Reviews,103, 577-644.

KEYWORDS: laser; plasma; ionization; visual obscurant; auditory deterrent; non-lethal weapon

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