

Noise Stimulation to Improve Soldier Shooting Performance



S&T Campaign: Human Sciences
Human Capability Enhancement

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Research Objective

- To determine whether sub-sensory vibratory or electrical noise applied to the skin can elicit a *stochastic resonance* (SR) effect to improve weapon aim stability and resulting marksmanship performance
- Contribute to newly-developing ARL research thrust in the area of human performance augmentation



Figure 1. Tactors and bipolar electrodes for applying vibratory or electrical stimulation.

Key Concept: Stochastic Resonance

A natural phenomenon in which signal detection in a non-linear system is improved with the addition of noise rather than degraded.

Challenges

- Determining appropriate signal content (frequency bands, amplitude)
- Identifying the most effective site of application (feet, shoulders, hands, wrists)
- Selecting the most effective mode (vibratory, electrical) of noise stimulation

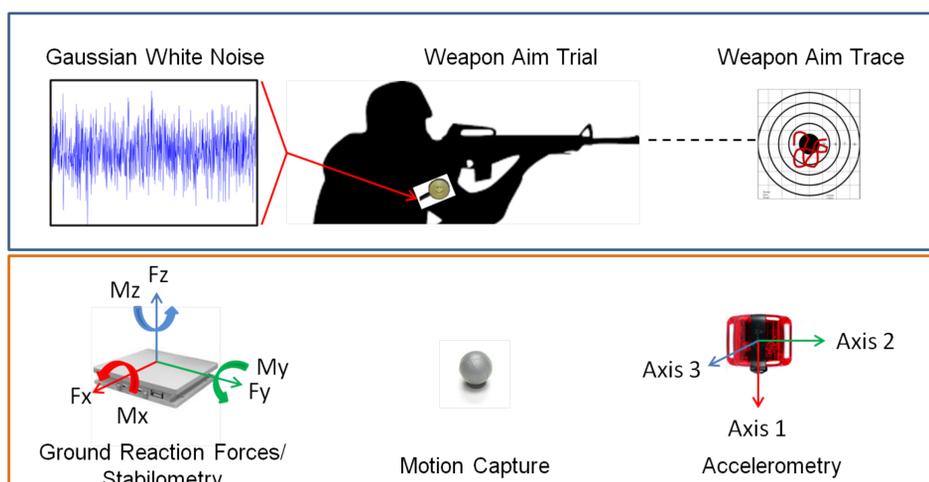
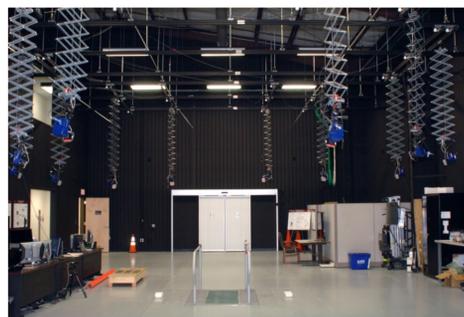


Figure 2. Schematic of lab-based protocols. Electrodes or tactors will be positioned at different locations on the body and used to apply sub-sensory Gaussian white noise to a subject completing a weapon aiming task. Weapon aim stability will be quantified using standard biomechanics techniques.

ARL Facilities and Capabilities Available to Support Collaborative Research

- Methods to include:
 - Lab-based measures of weapon aim stability with different stimulation conditions
 - Live-fire shooting trials with and without noise stimulation

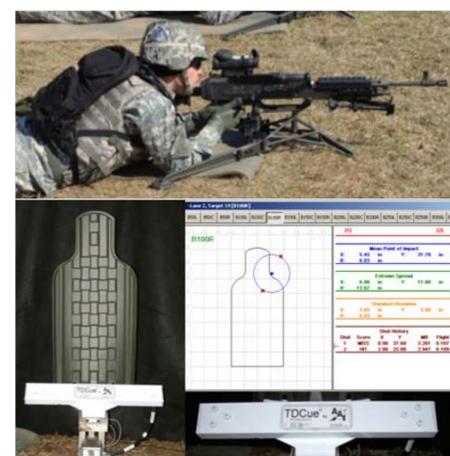
Soldier Performance and Equipment Advanced Research (SPEAR) facility at APG, MD



- 12-camera motion capture system
- Force plates and A/D boards
- Accelerometers/activity monitors
- Electromyography

M-Range Live-Fire Shooting Facility at APG, MD

- 4 firing lanes with range of up to 1000 m
- Acoustic sensors and optical target tracking for shot scoring and timing
- Pneumatic pop-up targets
- Personnel experienced in handling and conducting research with small arms



- ARL HRED Dismounted Warrior Branch has expertise in biomechanics and quantifying shooting performance
- ARL HRED Perceptual Sciences Branch has many years of experience using tactors for stimulation and signaling

Complementary Expertise/ Facilities/ Capabilities Sought in Collaboration

- Expertise in noise-enhanced motor performance or previous work with stochastic resonance
- Digital signal processing expertise
- Potential future application/research direction:
 - Determine if negative effects of fatigue (decreased stability and joint proprioception) can be reduced with sub-sensory noise
 - Incorporation of sub-sensory stimulators in Soldier uniform to improve field performance