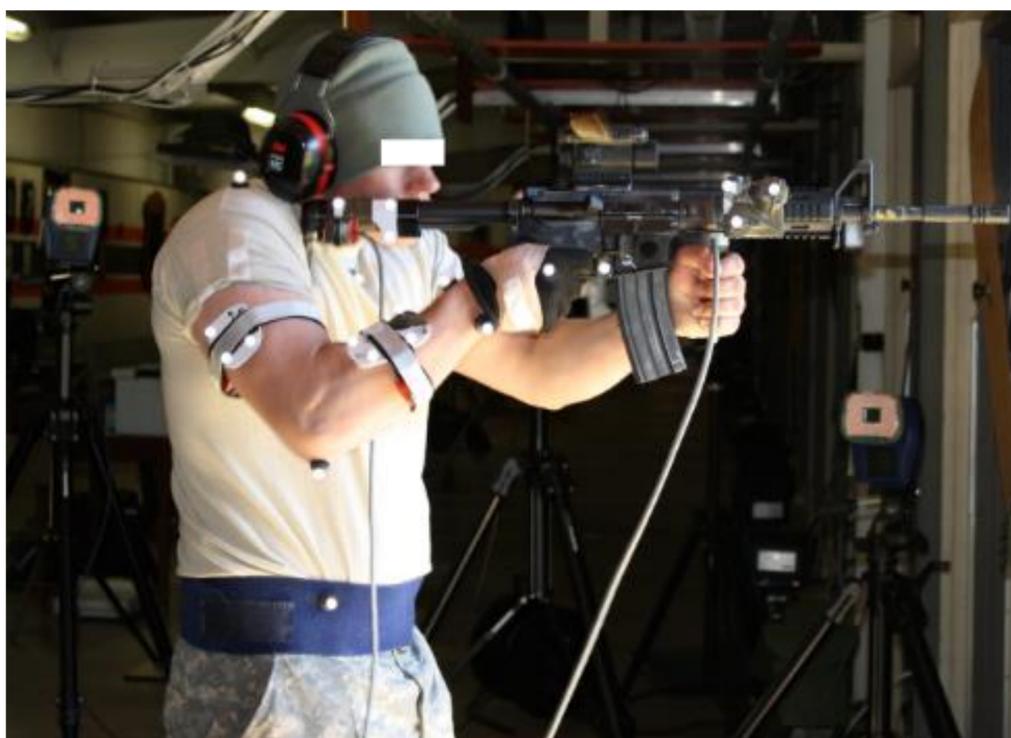


## S&T Campaign: Human Sciences Human Capability Enhancement Augmentation

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### Research Objective

- Augment human performance to improve lethal effects during target engagement by recording novel data streams associated with target engagement. Focus on shooter-weapon interface design and examination of target engagement dynamics and decision making processes



Shooter and Weapon instrumented to record live-fire weapon dynamics

### Challenges

- Coupling of eye movement data with weapon sighting systems, long-range aim trace characterization and high-precision off-axis aiming solutions
- Unobtrusive, untethered and ruggedized design of instrumentation, aim stabilization mechanisms
- Environmental and contextual constraints (e.g., ambient IR, wind, movement, visual obfuscation)



Shooter fitted with novel aim stabilization device

### ARL Facilities and Capabilities Available to Support Collaborative Research

- **M Range Experimental Shooting Performance Facility**
  - Shooter-Weapon Dynamics Laboratory
  - Weapon Recoil Simulated Shoulder (WRSS)
  - Instrumented Weapon Dynamics Mount
  - Acoustic and Optical "Location of Miss and Hit" (LOMAH) Targetry
  - Live-fire Eye Movement Characterization
  - Live-fire Aim Trace Characterization
- Unique expertise in research and development for human performance optimization using standard, custom and unique small arms systems and scoring instrumentation technologies
- Early findings indicate performance improvement potential based on novel interface design
- Selected publications and presentations

Morelli, F., Wingard, Z., Baechle, D.M. & Brant, A.L. (2016). Physical Augmentation Concept for Improved Soldier Lethality. Proceedings of the 2016 NDIA Human Systems Conference, Springfield, VA.

Webster, C.A., Morelli, F. and Neugebauer, J.M. (2015). Pre-shot jitter during self-paced firing using small arms weapon systems. Proceedings of the 2015 Annual Meeting of the American Society of Biomechanics, Columbus, OH.

Morelli, F., Fry, T.C., Ludwig, W. & Struve, D.J. (2015). Validation of the Optical Computer Aided Training (OCAT) system: Novel application of a training aid for small arms human performance research and development. Proceedings of the 2015 NDIA Human Systems Conference, Alexandria, VA.

Ortega, S.V., Harper, W.H. & Morelli, F. (2015). Quantifying Soldier Shooting Performance of the M4 Carbine with and without a Vertical Grip. U.S. Army Research Laboratory Technical Report (ARL-TR-7173).

Shorter, P., Morelli, F. & Ortega, S.V. (2014). Shooting Performance as a Function of Shooters' Anthropometrics, Weapon Design Attributes, Firing Position, Range and Sex. U.S. Army Research Laboratory Technical Report (ARL-TR-7135).

Morelli, F., Neugebauer, J.M., Webster, C. and LaFiandra, M.E. (2014). Portable method for measuring live-fire, shooter-in-the-loop weapon recoil dynamics. 3rd International Congress on Soldiers' Physical Performance, Boston, MA.

Morelli, F., Neugebauer, J., LaFiandra, M.E., Burcham, P. & Gordon, C. (2014). Recoil measurement, mitigation techniques and effects on small arms weapon design and marksmanship performance. *IEEE Transactions on Human-Machine Systems*, 44(30), 422-428.

Morelli, F. & Harper, W.H. (2013). Weapon and Sighting System Compatibility Assessment for Prototype Maxillofacial Protection Devices. U.S. Army Research Laboratory Technical Report (ARL-TR-6367).

### Complementary Expertise / Facilities / Capabilities Sought in Collaboration

- High-speed image capture, motion capture, force/pressure transfer characterization for human-weapon interface dynamics
- Expertise in physics, mechanics of weapon system cycling; Expertise in perception of visual and auditory stimuli (e.g., relative to target scenes, weapon function and interactive effects)
- Suggestions for innovative new research approaches to address rapid target identification and engagement within environmentally and tactically complex scenes