Human Effects & Effectiveness

Non-Lethal Weapons Research and Technology Development

Industry Day

22 June 2012

Alicia Owsiak

Deputy Technology Division Chief

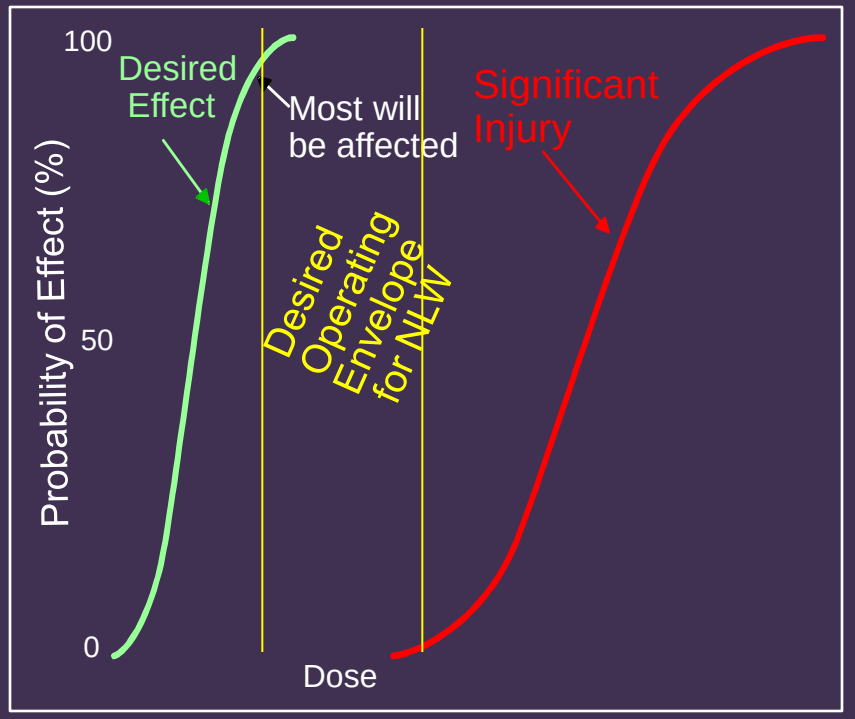
http://jnlwp.defense.gov

Background

- Understanding human effects and effectiveness is paramount in the development of non-lethal weapons.

- For NLW, two competing objectives exist: cause a desired effect, while minimizing permanent injuries or fatalities.

- The JNLWP is focused on all aspects of human effects and effectiveness research, across the breadth of non-lethal stimuli, that enables the development, test and fielding of safe and effective non-lethal weapons.



Technical Objectives

- Determine the ability of stimuli/systems to produce relevant physiological effects
- Identify and quantify risk
  - Risk of significant injury (RSI)
- Characterize effects to help inform effects-based design
- Characterize behavioral response
- Develop, verify and validate predictive models

Relevant Work

- Human Effects Modeling & Analysis Program
  - Performers:
    - Human Effects Center of Excellence (HECOE)
    - L-3 Communications / Jaycor
  - Focus:
    - Develop a suite of validated, verified, and Service-accredited human effects models across all non-lethal stimuli for application to support JNLWP
      - E.g., Advanced Total Body Model
    - Expand model(s) to include prediction of operational outcomes (behavior response)

Relevant Work

- RF Bioeffects
  - Performers: U.S. Air Force Research Lab
  - Focus:
    - Conduct human effects studies to support development of RF non-lethal directed energy weapons technologies (i.e., ADT, RF vehicle/vessel stopping).
      - Characterizing injury risk and effectiveness
      - Facilitate RF directed energy system development, test and evaluation
    - Model effects of RF Vehicle Stopper waveform as relates to size of individual within a vehicle.
    - Model and assess polarization risks associated with the RF Vessel Stopper waveform.

Relevant Work

- Human Effects Risk Assessments
  - Performers:
    - U.S. Air Force Research Lab
  - Focus:
    - Investigate the effects of vertical & horizontal polarization for specific radio frequency sources.
    - Model bioeffects associated with RF system designs.
    - Establish the safety of implanted medical devices for vehicle stopping technologies.
      - RF Vehicle Stopper
      - Pre-Emplaced Electric Vehicle Stopper

Relevant Work

- Underwater Acoustic Bioeffects
  - Performers:
    - Naval Submarine Medical Research Laboratory (NSMRL)
  - Focus:
    - Develop an underwater acoustic bioeffects model for impulse and continuous sound waves.
    - Establish target effectiveness and risk dose-response curves for the Anti-Swimmer Grenade though human subject diver experiments.

References

- DoDI 3200.19, "Non-Lethal Weapons (NLW) Human Effects Characterization" (2012)
  - http://www.dtic.mil/whs/directives/corres/pdf/320019p.pdf
- "Non-Lethal Weapons Human Effects" Simonds (2008)
- "Human Effects Modeling Analysis Program (HE-MAP): Models for Human Effects Characterization" DeChancie. *2011 Annual Directed Energy Symposium Proceedings* (2011)
- "Risk of Significant Injury" Simonds. 2011 *Annual Directed Energy Symposium Proceedings* (2011)
- "Experiments in Modelspace: Leveraging Human Effectiveness Models and Statistical Design of Experiments to Estimate Non-Lethal Weapon Performance" Fleming. 2011 *Annual Directed Energy Symposium Proceedings* (2011)
- "An Effects-Based Design Approach Using Human Effectiveness Modeling and Simulation to Assist in the Definition and Validation of Warfighter Requirements" DeNeve. 2011 *Annual Directed Energy Symposium Proceedings* (2011)

Research & Development Tasks

General types of tasks required for human effects and effectiveness research:

- Dose response curve generation for various non-lethal stimuli as relates to risk of injury and efficacy
- Feasibility assessments to determine the ability of stimuli/systems to produce relevant physiological effects
- Risk of injury prediction methodology development for various stimuli
- Quantification of risk of significant injury (RSI) for various systems
- Studies and human subject experimentation to characterize behavioral response
- Bioeffects research to include animal and human subject research
- Model development, verification and validation
- Simulation development
- Assessment of variables that could impact safety and effectiveness

Capabilities

General capabilities and expertise that may be required to execute planned R&D human effects and effectiveness tasks:

- Engineers/Scientists with expertise in:
  - Biophysics
  - Biomedical science
  - Radio frequency bioeffects
  - Veterinary medicine
  - Statistics
  - Electrobiology
  - Medicine
  - Behavioral science
  - Biology
  - Biochemistry
  - Modeling and simulation
  - Physiology
- Facilities and equipment to conduct indoor and outdoor laboratory experiments
- Accredited institutional controls for bioeffects research:
  - Institutional Review Board (IRB)
  - Institutional Animal Care and Use Committee (IACUC)

Questions?

Please submit questions by 29 June 2012:

wesley.burgei@usmc.mil

and

alicia.owsiak@usmc.mil